

TAXONOMY OF PERITYLE SECTION PERITYLE (COMPOSITAE — PERITYLINAE)¹

A. MICHAEL POWELL

Section PERITYLE, with 27 species and three varieties, is the largest of three sections of the genus *Perityle* (Powell, 1968a). The distributional center of sect. PERITYLE is in northwestern Mexico and the Baja Californian peninsula, but the total natural range is extended by several taxa that occur in the southwestern United States, Guadalupe Island, the Revillagigedo Islands, and west-central Mexico (Jalisco). One weedy taxon, *P. emoryi*, has bicontinental distribution in North America and in Chile and Peru in South America. Separate taxonomic works have been prepared for the other two sections of the genus; *Pappothrix* (Powell, 1969) and *Laphamia* (Powell, 1973).

The species of sect. PERITYLE comprise a taxon that was recognized as the genus *Perityle* by Everly (1947) who compiled a taxonomic treatment of the group. In connection with her morphologically oriented investigations of *Perityle*, Everly also studied the closely related taxa *Pappothrix* and *Laphamia*, which she regarded as genera. These taxa are distinguished primarily by somewhat variable pappus and achene characteristics, and several workers have questioned their status as genera. Shinnars (1959) merged *Pappothrix* and *Laphamia* with *Perityle*, noting their close morphological relationship and contending that pappus differences were not sufficient to warrant separate generic status. In recognizing *Pappothrix* and *Laphamia* as sections of *Perityle*, I have followed Shinnars' congeneric disposition of the taxa (Powell, 1968a). My systematic judgements were based upon the evaluation of new information from cytological, chromatographic, and hybridization techniques, as well as a re-evaluation of morphological features. The re-

¹Supported by National Science Foundation Grants GB-7740 and GB-20361.

sults have suggested that *Pappothrix*, *Laphamia*, and *Perityle* are closely related, essentially natural phylads, and that they are best treated as sections of a single genus. Niles (1970), however, has maintained *Perityle* and *Laphamia* as distinct genera, while combining *Pappothrix* with *Laphamia*. Niles did not conduct a comprehensive study of the sect. PERITYLE species. A more complete review of the taxonomic history concerning *Perityle* is available elsewhere (Shinners, 1959; Powell, 1968a; Niles, 1970).

Perityle is closely allied to *Pericome*, *Amauria*, and *Eutetras* of the subtribe Peritylinae (Helenieae). Rydberg (1914) assigned *Perityle* and *Pericome* to the Peritylinae and *Amauria* and *Eutetras* to the subtribe Amaurinae. Turner (1966) and Powell (1972a) have suggested that Amaurinae (in part) should be combined with Peritylinae. Presently the Peritylinae is being re-evaluated with reference to Rydberg's concepts, and the proper tribal position of the subtribe is also being investigated (Powell & Turner, unpublished).

CHROMOSOMAL CONSIDERATIONS

A discussion of the chromosome numbers of *Perityle* and related genera is presented elsewhere (Powell, 1968b). Additional counts for the species of sect. PERITYLE are reported in Powell and Sikes (1970) and Powell (1972b). Chromosome numbers have been obtained for 20 of the 27 species of sect. PERITYLE. The counts for specific taxa are included with a list of the species under Phylogenetic Considerations (Table 1), and they are also included with species discussions in the taxonomic portion of this paper.

In Powell (1968b), a few changes must be noted with regard to the counts for sect. PERITYLE. When the 1968 paper was compiled, the taxonomic studies of sect. PERITYLE were in early stages. The reports of $n = 16$ for *P. californica* should be attributed to *P. cuneata* var. *marginata*. *Perityle incompta* is now considered as synonymous with *P. crassifolia* var. *robusta*, and the counts listed for the former ($n = 19, 18$) should be attributed to the latter

taxon. The diploid *P. microglossa* (Sikes and Babcock 185 a,b,c,f,) is *P. microglossa* var. *saxosa*, and the polyploid *P. microglossa* (Sikes and Babcock 177 192 a-d, 152, 157 a, 206 a,b,) is var. *microglossa*. Sikes and Babcock 188 a,b,d,f, and 190 a,b, listed as *P. palmeri*, are *P. cordifolia* ($n = 17$). *Perityle* cf. *spilanthoides* is *P. turneri* ($n = 17$) and *P. vaseyi* (Sikes 116) is *P. parryi* ($n = 17$).

Most species of sect. PERITYLE are diploid, with counts of $n = 19, 18, 17, 16, 13, 12$, and 11 having been reported for the various taxa (Powell, 1968b; 1972b). Only *P. microglossa* var. *microglossa* ($n = 34, 51$), *P. emoryi* ($n = 32-36, 50-57$), and *P. incana* ($n = 50-57$) are known to be polyploid. The first two taxa are relatively well established as exclusively polyploid, while only one count for the Guadalupe Island endemic *P. incana* (Powell, 1972b) has been recorded. Turner and Flyr (1966) reported $n = \text{ca. } 46$ for *P. crassifolia* var. *robusta* (Cowan 2265), but I have since identified this collection as *P. emoryi*. A base number for *P. emoryi* has not been determined in spite of numerous attempts to obtain exact counts (Powell, 1968b).

The ancestral base number for sect. PERITYLE has not been established. Subsequent to an earlier discussion of the subject (Powell, 1968b), all attempts to resolve the question have been unsuccessful, including those which involved the analysis of experimental hybrids (Powell, unpublished). Most chromosomal and distributional evidence suggest a base of $x = 17$ for sect. PERITYLE, and the genus as a whole (see Phylogenetic Considerations). Fourteen species of sect. PERITYLE are $n = 17$, and both sect. PAPPOTHRIX (5 spp.) and sect. LAPHAMIA (21 spp.) are $x = 17$ (Powell, 1969; 1973). The taxa of sect. PERITYLE with chromosome numbers below $n = 17$, *P. californica* ($n = 13, 12, 11$) and *P. cuneata* ($n = 16, 12$), are clearly aneuploid derivatives, probably of the $n = 17$ line. However, the origin of taxa with $n = 19$ (*P. crassifolia* and allies) is of prime concern in evaluating the phylogeny of sect. PERITYLE. Distributionally, the $n = 19$ "alliance" ((southern Baja California peninsula and neighboring islands) is pe-

ripheral to the group where $n = 17$, which is centered on the mainland of Mexico (see Phylogenetic Considerations). The $n = 19$ group may be either ancestral to or derived from the $n = 17$ group (Powell, 1968b), but I now believe that the species with $n = 19$ and the species with $n = 17$ both evolved as separate lineages from a common "mainland" ancestor that had a chromosome number of $n = 19$ (or 18). Consideration of the latter hypothesis in a broader sense is supported by the base numbers of the related genera *Pericome* ($x = 18$), *Eutetras* ($x = 18$), and *Amauria* ($x = 18$).

ARTIFICIAL HYBRIDIZATIONS

Artificial hybridizations have been conducted with 16 species of sect. PERITYLE. Many of the crosses were of intergeneric and intersectional nature, although several interspecific combinations have been obtained. The results of most of these crosses are discussed in another paper (Powell, 1972c) where emphasis was placed upon evaluation of the intergeneric and intersectional relationships of *Perityle*. A hybridization program aimed at the evaluation of interspecific relationships within sect. *Perityle* is still in progress (Powell, unpublished). Where appropriate, some of the preliminary information derived from artificial crosses will be brought into species discussions in the taxonomic portion of this paper.

Natural hybridization is rare in sect. PERITYLE, and only one such occurrence has been documented (Powell, 1970). Most of the species are geographically isolated, but a few taxa do have overlapping ranges and may occasionally hybridize.

CHROMATOGRAPHIC CONSIDERATIONS

Nineteen species of sect. PERITYLE were analyzed by 2-dimensional paper chromatography of leaf extracts. In general, the techniques outlined by Alston and Turner (1963) were utilized. The procedures for sampling popu-

lations and analyzing chromatograms have followed those discussed elsewhere (Powell, 1973). The major components of chromatographic patterns were characterized as flavonoids (Powell and Tsang, 1966; Powell and Averett, unpublished), although the specific identity of only one compound is known (Southwick et al., 1972).

The use of chromatographic techniques has been a valuable asset to previous taxonomic studies in the Peritylinae (Powell and Tsang, 1966; Powell, 1968a; 1969; 1973). Intergeneric and infrageneric relationships have been clarified through the comparative analysis of pattern data. In previous work I treated the crude chemical information from a chromatographic pattern as a single taxonomic character, and pattern data have not been given more weight than any other character.

The results of chromatographic studies in sect. PERITYLE have revealed two strikingly different chemical patterns based upon the presence or absence of yellow compounds as seen under ultraviolet light. The white-flowered species centered in the Sierra Madre Occidental (e.g., *P. turneri*), and the yellow-flowered species of northwestern Mexico and Baja California (e.g., *P. cordifolia* and *P. californica*) have simple patterns consisting of a few dark purple spots. The Baja Californian white-flowered species (e.g., *P. crassifolia*), and the Texas yellow-flowered species (e.g., *P. parryi*) have relatively complex patterns that include prominent yellow spots. Yellow compounds are considered important because they comprise the basic chromatographic profile of sect. PAPPOTHRIX, sect. LAPHAMIA, and the genera related to *Perityle*. The actual chromatographic data are not presented here in the form of figures or tables. Instead, where appropriate, the data are included in succeeding discussions concerning relationships of species and species groups.

ECOLOGICAL AND REPRODUCTIVE CONSIDERATIONS

The species of sect. PERITYLE occur in rock and in soil habitats, unlike the species of sect. PAPPOTHRIX and LAPHAMIA.

MIA, which are exclusively rock-dwelling (Powell, 1969; 1973). Certain species of sect. PERITYLE are obligate, rock-dwelling perennials, while several perennial and annual taxa are soil-obligates. In addition, a few taxa display facultative existence in rock and soil habitats.

The rock-dwelling members of sect. PERITYLE occur under a wide range of climatic conditions and at various elevations. About half of the petrophilic taxa are occupants of protected canyons and exposures in relatively xeric desert mountains at altitudes of 1000-4000 feet or less, and the others thrive under relatively mesic conditions at altitudes of 4000-8000 feet. *Perityle turneri* also occurs under mesic conditions, at 7000-9500 feet in and near Durango, Mexico, but may be rooted primarily in matted soils. The other soil-dwelling taxa occur almost exclusively under desert conditions.

Perityle is essentially a genus of self-incompatible species (Powell, 1972c). Only two of the taxa, *P. emoryi* and *P. microglossa* var. *microglossa*, are known to be self-compatible, and these are members of sect. PERITYLE. Ten species have not been tested for the compatibility factor, two of sect. LAPHAMIA and eight of sect. PERITYLE, but these taxa are also probably self-incompatible. Both of the self-compatible taxa are widespread polyploids (Powell, 1968b; 1972c) that are "weedy" and annual in habit. *Perityle emoryi* is the most widespread species of the genus, having bi-continental distribution in North and South America, and *P. microglossa* var. *microglossa* probably ranks second in distributional range. Several other species of the genus are polyploid, and a few others are annual, thus suggesting that the capacity for reproductive self-compatibility has allowed for the "weedy" nature of two taxa.

PHYLOGENETIC CONSIDERATIONS

Speculation concerning phylogeny of the subtribe Peritylinae and the genus *Perityle* has been discussed generally elsewhere (Powell, 1973), and will not be repeated in detail here. Essentially, it was proposed that Peritylinae origi-

nated in the southern Sierra Madre Occidental of Mexico. *Perityle* is by far the most successful genus of the subtribe, in terms of number of species, with only 2 or 3 species being recognized for each of the other genera (Powell, 1972a; 1972d; and Turner, 1966). Section PERITYLE is assumed to be ancestral to the other two sections of the genus. Based upon distributional, morphological, chromosomal, and other considerations, it is believed that sects. PAPPOTHRIX and LAPHAMIA underwent rapid evolution in late Pliocene or Pleistocene emanating from an ancestral sect. PERITYLE complex (Powell, 1973).

Modes of speciation in the subtribe Peritylinae, and *Perityle* in particular, have been discussed elsewhere (Powell, 1969; 1972c; 1973). In sects. PAPPOTHRIX and LAPHAMIA, speciation is believed to have occurred mostly, if not entirely, as a result of geographic isolation. In sect. PERITYLE, speciation probably has occurred as a result of geographic isolation and other, more nearly reproductive phenomena (Powell, 1972c). This subject will be discussed further below.

In Table 1 the list of sect. PERITYLE species is presented as an aid to discussing phylogenetic considerations. The list has been organized to depict the hypothetical evolutionary groupings within the section. The arrangements are based upon morphological, chromosomal, experimental, chromatographic, and eco-geographical data. Additional discussions of species relationships, including the evidence upon which such judgements are based, are included in the taxonomic portion of this paper.

The total data suggest that sect. PERITYLE comprises at least two distinct evolutionary series. One series, including the first 19 taxa, is marked by white ligules and yellow (or cream-white) disc corollas, with a few exceptions, as indicated in Table 1. *Perityle incana* and the *P. jaliscana* group are relatively anomalous in the "white-flowered series" and they may comprise separate and equal phyletic entities. A second major series can be delimited by its exclusively yellow flowers.

Table 1. Section Perityle species and summary of gametic chromosome numbers
Taxa listed according to flower color and presumed related-species groups.

WHITE-FLOWERED GROUPS		
White Rays and Yellow Disc		
1a. <i>P. crassifolia</i>		
var. <i>crassifolia</i>	19	
1b. <i>P. crassifolia</i>		
var. <i>robusta</i>	19	
2. <i>P. socorrensis</i>	19	
3. <i>P. emoryi</i>	32-36, 50-57	
4. <i>P. aurea</i> (yellow rays)	17	
5. <i>P. incana</i> (discoid)	50-57	
6. <i>P. turneri</i>	17, ca. 17	
7. <i>P. lineariloba</i>	not counted	
8. <i>P. microcephala</i>	not counted	
9a. <i>P. microglossa</i>		
var. <i>microglossa</i>	34, 51	
9b. <i>P. microglossa</i>		
var. <i>saxosa</i>	17, 18	
10. <i>P. canescens</i>	not counted	
11. <i>P. ciliata</i>	17	
12. <i>P. coronopifolia</i>	(16) * 17	
13. <i>P. hofmeisteria</i>	ca. 17	
YELLOW-FLOWERED GROUPS		
White Rays and Cream-White Disc		
14. <i>P. jalsicana</i> (discoid)		17
15. <i>P. rosei</i>		not counted
16. <i>P. trichondonta</i>		not counted
17. <i>P. feddema</i> (discoid)		not counted
YELLOW-FLOWERED GROUPS		
18. <i>P. parryi</i>		17
19. <i>P. vaseyi</i>		17 (19)
20. <i>P. aglossa</i> (discoid)		17
21. <i>P. cordifolia</i>		17
22. <i>P. leptoglossa</i>		17
23. <i>P. lloydii</i>		not counted
24. <i>P. lobata</i>		17
25. <i>P. palmeri</i>		17 (19)
26. <i>P. californica</i>		11, 12, 13
27a. <i>P. cuneata</i>		
var. <i>cuneata</i>		12
27b. <i>P. cuneata</i>		
var. <i>marginata</i>		16

*Numbers in parentheses have been reported for the respective taxa, but are thought to be erroneous.

Several related-species groups are further delimited within both the "white-flowered series" and "yellow-flowered series" (Table 1). The groupings themselves comprise clearly related taxa, but the phyletic unity of the related-species groups within monophyletic white- or yellow-flowered series is indefinite. For example, origin of the Baja Californian *P. crassifolia* group has not been connected resolutely with the Sierra Madre Occidental *P. turneri* group, even though both exhibit white ligules. And the anomalous nature of *P. incana* and the *P. jaliscana* group is indicated above. Also, there is no certainty that the *P. parryi* group of Texas and the aneuploid *P. californica* group of Baja California have monophyletic ties within a yellow-flowered series.

White-Flowered Groups (Table 1). Three subgroups of the white-flowered series are recognized. These are designated as the *Perityle crassifolia*, *P. turneri*, and *P. jaliscana* related-species groups. Distributional information, habitat preferences, and life form habits are given in the following discussions because of their supposed importance in understanding speciation in the genus.

The *Perityle crassifolia* group, also including *P. socorrensis*, *P. emoryi*, and *P. aurea*, is distributed in southern Baja California and nearby islands, except for *P. emoryi* which is a widespread weed. Also, *P. socorrensis* is found only in the Revillagigedo Islands, which are over 200 miles south of Baja California.

Perityle emoryi ($n = 32-36, 50-57$) is believed to be a polyploid derivative of *P. crassifolia* var. *robusta*. Morphological and chromatographic data strongly suggest that *P. aurea* belongs with the *P. crassifolia* ($x = 19$) group even though this taxon has yellow-ligules and a chromosome number of $n = 17$.

Both *Perityle emoryi* and *P. aurea* are annual in habit, while the other taxa of the *P. crassifolia* group are essentially soil-dwelling perennials. All of the taxa, however, with the exception of *P. crassifolia* var. *crassifolia* which seems restricted to sand, might also occur in soil-filled

crevices of rocks especially at sea side. The Guadalupe Island endemic *P. incana*, is possibly allied with the *P. crassifolia* group, but evidence as to its true relationship has not been conclusive.

The base chromosome number of the *Perityle crassifolia* group is presumed to be $x = 19$, a number that might be ancestral in sect. *Perityle*. On morphological and distributional grounds, however, it is practically impossible to envision the other related species groups as having been derived from the *P. crassifolia* line. I believe that the *P. crassifolia* line was an early offshoot from ancestral *Peritylinae*.

The largest related-species group of the white-flowered series is distributionally centered in the Sierra Madre Occidental of mainland Mexico. Two assemblages of four species each are further distinguishable among this *Perityle turneri* group, primarily on the basis of floral characters. *Perityle turneri*, *P. microcephala*, and *P. lineariloba* are clearly allied taxa which occur at relatively high altitudes from Durango to central Chihuahua. The fourth member of this assemblage is *P. microglossa*, which ranges from northern Sonora along the west coast of Mexico south to Colima, into the foothills of the Sierra Madre Occidental, and east to San Luis Potosi and Texas. Habit and distributional considerations (see Taxonomy) strongly suggest that *P. microglossa* is derived from *P. microcephala*. I believe that *P. turneri* is primitive in this assemblage, on the basis of features discussed elsewhere (Powell, 1972e).

Perityle coronopifolia, *P. ciliata*, *P. hofmeisteria*, and *P. canescens* are also clearly allied members of the *P. turneri* group. *Perityle coronopifolia* extends from northern Chihuahua into the mountains of southern Arizona and southern New Mexico. *Perityle ciliata* is restricted to central Arizona, while *P. hofmeisteria* and *P. canescens* apparently are endemics respectively in Durango and in Sinaloa, Mexico.

Most members of the *Perityle turneri* group are hardy, suffrutescent perennials that live in crevices of rock bluffs.

Perityle turneri is a rhizomatous perennial, apparently occurring typically in thin soil covering rocky outcrops, but according to label data, the taxon might also be rock-dwelling. *Perityle microglossa* is a soil-dwelling annual, also found occasionally among rocks, and one collection of *P. hofmeisteria* (Flyr 332) is said by the collector to be "seemingly an annual." Judging from known distributional data, these species are strictly allopatric, suggesting that they have undergone the type of geographic speciation that is considered typical for sect. PAPPOTHRIX and sect. LAPHAMIA (Powell, 1969; 1973).

The white-rayed (or discoid) *Perityle jaliscana* group with cream-white discs comprises very closely related rock-dwelling perennial taxa that are restricted to Jalisco, Mexico. These taxa represent a third distinct assemblage within the white-flowered species of sect. PERITYLE.

The three white-flowered subgroups are clearly delimited morphologically, with perhaps the most useful distinguishing features being those of the habits, achenes, and pappus (see Taxonomy). The yellow-flowered species are quite different superficially, but the generic unity of both white- and yellow-flowered assemblages is evident.

Yellow-Flowered Groups (Table 1). Geographically, the yellow-flowered species are divided into two major assemblages separated by the Sierra Madre Occidental. One assemblage, designated as the *Perityle parryi* group, has a limited distribution in the Big Bend area of western Texas and adjacent Mexico, and the other geographic assemblage, including the *P. cordifolia* and *P. californica* groups, is more widely distributed in Sonora, Sinaloa, and Baja California, Mexico.

The three species of the *Perityle parryi* group are closely related perennials, being distinguished on the basis of a few morphological characters. One of the taxa, *P. aglossa*, apparently is exclusively rock-dwelling in habit, while *P. vaseyi* seemingly occurs only in desert soils. *Perityle parryi*, however, is facultative in its existence in rocks and soils.

There are interesting biological parallels between the

Perityle parryi group and the *P. cordifolia* group of western Mexico, and despite their geographic separation, most evidence suggests that both groups had common origin. Both alliances comprise closely related taxa, their vegetative and floral morphologies are strikingly similar, and species of both groups have chromosome numbers of $n = 17$ with no polyploidy having been discovered in any of the taxa. Additionally, and most remarkably, the evolutionary pattern of the disjunct groups seems to be that soil forms were established when woody perennials "came down out of the rocks and adapted to life in the soil." *Perityle cordifolia*, *P. leptoglossa*, and *P. lloydii* seem to be obligately (at least typically) rock-dwelling, while *P. palmeri* and *P. lobata* apparently are facultative in their tolerance for existence in rocks or in soils.

The presumed "close" phylogenetic relationship between the *Perityle parryi* and *P. cordifolia* groups is not supported by their chemical profiles. Members of the *P. parryi* group produce abundant yellow components, as do *P. crassifolia* and allies, while chromatographic samples of the *P. cordifolia* group have revealed only simple patterns of purplish spots. The chemical indication of affinity between the *P. parryi* and *P. crassifolia* groups is complemented by a tenuous morphological feature they have in common. *Perityle vaseyi* (rarely *P. parryi*, also) of the former alliance and pappose members of the *P. crassifolia* group are the only taxa of the genus which have awns with retrorsely-barbed tips. In view of the morphological dissimilarity and geographic distance between these groups, however, I believe that the crude chemical data and pappus structure merely reflect an ancestral connection between the *P. crassifolia* and yellow-flowered alliances. If this is true, then the *P. cordifolia* group must have lost its ability to produce the prominent yellow flavonoids.

Both species of the *Perityle californica* group are soil-dwelling annuals. The taxa are of special systematic interest in sect. PERITYLE because of their reduced chromosome numbers. All other yellow-flowered taxa have $n = 17$.

Perityle californica ($n = 13,12,11$) is distributed in Sonora and Sinaloa of mainland Mexico and along most of the Baja California peninsula to just south of La Paz. *Perityle cuneata* ($n = 16,12$) is restricted to the southern tip of Baja California with northern limits to about the latitude of La Paz.

Judging from overall morphological similarity and distributional considerations, it is assumed that *Perityle californica* and *P. cuneata* are aneuploid derivatives of the *P. cordifolia* line. With the exception of the *P. parryi* group, which seemingly would be ruled out on distributional grounds, only the *P. cordifolia* group bears any close resemblance to the aneuploids. *Perityle californica* occurs sympatrically with *P. cordifolia* and *P. palmeri* in Sonora and Sinaloa, apparently without hybridization. Since most species of *Perityle* are allopatric, but artificially interfertile (Powell, 1972c), it is reasonable to conclude that *P. californica* achieved reproductive isolation and speciation through reduction in chromosome number.

Summary of Phylogenetic Considerations. Species of the genus *Perityle* are distributed primarily in the arid to semimesic mountains of desert North America, but also in the higher mountains, for example in the Sierra Madre Occidental. The majority of the species are obligate rock-dwellers. All five species of sect. PAPPOTHRIX and all 21 species of sect. LAPHAMIA occur as perennials in crevices of rock bluffs, apparently never growing in soil at the base of bluffs. That these species can survive only in such restrictive habitats surely imposes upon them evolutionary limitations. The basic evolutionary trends of sect. PAPPOTHRIX and LAPHAMIA have followed a pattern of speciation by geographic isolation; thus evolved the groups of closely related, mostly endemmic species, characteristic of the above sections.

Greater evolutionary diversity is exhibited among the species of sect. PERITYLE. Indeed, some species of this section are obligate, rock-dwelling perennials that presumably underwent the type of geographic speciation mentioned

above. But several taxa have adapted to a facultative existence in rocks and in soils, and a few species are exclusively soil-dwelling with perennial or annual habits. For certain taxa, the adaptation to life in the soil apparently has been facilitated by two evolutionary mechanisms, polyploidy and aneuploidy. Emanating from the white-flowered groups, the widespread weeds *Perityle microglossa* var. *microglossa* ($n = 34, 51$) and *P. emoryi* ($n = 32-36, 50-57$) exemplify the adaptive success of polyploidy. *Perityle californica* ($n = 11, 12, 13$) and *P. cuneata* ($n = 12, 16$) are successful aneuploid species of yellow-flowered lineage. Thus, along with the annual habit displayed by the above species, the phenomena of polyploidy and aneuploidy have independently advanced the adaptive capacity of species belonging to distinct evolutionary units of sect. PERITYLE.

ACKNOWLEDGEMENTS

I am grateful to the curators of herbaria from which specimens were borrowed. I am also grateful to B. L. Turner who suggested the study of *Perityle* and provided encouragement and advice throughout the study. I extend thanks to John Averett for his assistance in gathering literature; to Reid Moran for his help in providing vouchers, buds, and ecological information for *P. incana* and other species; to Rogers McVaugh for providing helpful observations and material of *P. microglossa* and *P. fedde-mae*; and to Annetta Carter for her assistance in providing specimens and ecological information for several species. Many other people have contributed to my studies of *Perityle* and related genera; they know of my appreciation. One person who did not know fully of my deep gratitude was the late Lloyd Shinnars. His special character will linger to inspire many taxonomists.

TAXONOMY

PERITYLE Benth. Bot. Sulph. 23. 1844.

Perityle section *Perityle*, see Powell, Sida 3: 277. 1968.

- Galinsogeopsis* Schultz-Bip. in Seem. Bot. Herald. 306. 1856.
Nesothamnus Rydb. N. Amer. Fl. 34: 12. 1914.
Leptopharynx Rydb. N. Amer. Fl. 34: 21. 1914. (in part).
Closia Remy in Gay, Fl. Chile 4: 120. 1849. (in part).

Plants shrubby, suffruticose, or herbaceous perennials, or delicate to robust annuals, (2) 10-80 cm high, growing in rock crevices or various soils, variously pubescent, tomentulose to nearly glabrous, frequently glandular-pubescent; leaves opposite or alternate, variable in size and shape, 0.7-14 cm long including the petiole, 0.2-7.0 cm wide, ovate, cordate, deltoid, subhastate, reniform, or suborbicular in outline, the margins subentire, serrate to doubly so, or shallow to deeply lobed or divided, frequently 3-5 lobed, pedate, subcruciform, or pinnatifid with narrow segments, nearly glabrous, puberulent, to arachnoid-villous, often glandular-pubescent, thick and semisucculent to thin in texture, viscid, bitter tasting, usually aromatic; capitulescence of solitary heads, or heads loosely to tightly aggregated in clusters of 3 or more; peduncles short or long; involucre subcylindric to hemispheric; heads 3-12 mm high, 4-15 mm wide; involucre of 2(3) subequal series, bracts ovate or obovate to narrowly oblanceolate, obtuse to attenuate at the apex, flattened, ribbed, or keeled, usually spreading or reflexing at maturity; heads radiate or discoid (in 4 spp.), ligules yellow or white, showy or rudimentary; disc flowers numerous, corollas 4-lobed, yellow or cream-white (in 3-4 spp.), throats tubular to broadly funnelform or narrowly campanulate; style branches, flattened, linear, usually tapering to a fine, minutely pubescent tip; achenes black when mature, 1.3-5.0 mm long, distinctly flattened radially, outer achenes often 3-angled, slightly curved and clasped by bracts, linear, oblong, oblong-elliptic, or oblanceolate, the margins densely ciliate, rarely merely puberulent, prominently calloused or the margins thin and not calloused, the faces glabrous and shiny or short-pubescent; pappus of a conspicuous, rarely inconspicuous, crown of laciniate, hyaline, squamellae, and 0-2 (rarely 3-4) delicate or rather stout bristles, 0.5-7.0 mm long, the bristles naked,

barbellate, or subplumose throughout or only at the tips, the barbs antrorse, lateral, or retrorse; base chromosome number, $x = 17$ or 19 .

Type: *P. californica* Benth.

Key to the Species

1. Heads discoid. 2.
2. Leaves canescent; Guadalupe Island, Mexico. 5. *P. incana*.
2. Leaves not canescent; Texas or Jalisco, Mexico . 3.
3. Pappus bristle 1, 3.7-5.5 mm long; disc corollas yellow; Texas. 20. *P. aglossa*.
- 3 Pappus bristles 2(3), 0.5-1 mm long; disc corollas cream-white or pale yellow; Jalisco. 4.
4. Leaves dissected. 17. *P. feddema*.
4. Leaves deltoid to subhalberd. 14. *P. jaliscana*.
1. Heads radiate. 5.
5. Ray and disc corollas yellow. 6.
6. Plants distinctly annual; pappus bristles 1 or 2 (or rarely absent). 7.
7. Achene margins thin, not calloused; single pappus bristle delicate (rarely absent), and retrorsely barbellate only at the tip. 4. *P. aurea*.
7. Achene margins usually prominently calloused; single pappus bristle rather stout and antrorsely subplumose, or 2 delicate bristles. 8.
8. Pappus bristle 1, subplumose, 1.5-3.5 mm long. 26. *P. californica*.
8. Pappus bristles 2 (rarely absent), delicate, 0.5-2.0 mm long. 9.
9. Achenes (2.5) 3-3.8 mm long, obcordate-cuneate, with broad, callous margins. . . . 27a. *P. cuneata* var. *cuneata*.
9. Achenes 1.5-2 (2.5) mm long, obovate to subcuneate with prominent callous

- margins.
- 27b. *P. cuneata* var. *marginata*.
6. Plants perennial, with woody bases, or herbaceous with fleshy taproots or rather thin branch roots. 10.
10. Plants of West Texas and adjacent Mexico. 11.
11. Leaves typically 3-lobed or subcruciform; taprooted perennials in soil. 10. *P. vaseyi*.
11. Leaves typically 3-lobed but not divided; woody-based perennials in rock crevices, or taprooted in soil. 18 *P. parryi*.
10. Plants of Sonora and Sinaloa, Mexico, and Baja California Sur. 12.
12. Plants subshrubs or suffrutescent perennials. 13.
13. Leaves densely puberulent and subcanescent. 22. *P. leptoglossa*.
13. Leaves pilose and green. 14.
14. Leaves 3.5-11 cm long; involu-
cral bracts 10-13 mm long. 21. *P. cordifolia*.
14. Leaves 2.5-4.5 cm long; involu-
cral bracts 5-7 mm long. 23. *P. lloydii*.
12. Plants herbaceous perennials with rather thin, fleshy roots. 15.
15. Leaf blades 3-5 lobed, cleft, parted or rarely divided, the margins den-
tate-lobed and acuminate; Baja
California Sur. 24. *P. lobata*.
15. Leaf blades shallowly or strongly
3-lobed, the margins serrate-den-
tate; Sonora and Sinaloa, Mexico.
. 25. *P. palmeri*.
5. Ray corollas white, disc corollas yellow, except disc
corollas cream-white in *P. rosea* and *P. trichodonta*.
. 16.

- 16. Disc corollas cream-white. 17.
- 17. Leaves 1.8-3 cm long, 1-1.5 (2) cm wide; ligules 2-2.5 mm long. 15. *P. rosei*.
- 17. Leaves 0.7-0.9 cm long, 0.25-0.5 cm wide; ligules 1-1.5 mm long. . . 16. *P. trichodonta*.
- 16. Disc corollas yellow. 18.
- 18. Achene margins thin, not calloused; heads 0.6-1 cm high, 0.6-1.5 cm wide, but possibly smaller in *P. emoryi*; Baja California Sur and islands, except *P. emoryi* widespread. 19.
- 19. Ligules 6-10 mm long. 20.
- 20. Leaves usually thick and crisped, arachnoid-villous; Baja California Sur, coastal dune sand. 1a. *P. crassifolia* var. *crassifolia*.
- 20. Leaves usually rather thin and not crisped, densely short-pubescent to glabrous; Baja California Sur, in various soils. 1b. *P. crassifolia* var. *robusta*.
- 19. Ligules 1.5-4 (6) mm long (rarely absent). 21.
- 21. Plants suffruticose perennials; Revillagigedo Islands. 2. *P. socorrensis*.
- 21. Plants delicate or robust annuals; widespread weed. . . 3. *P. emoryi*.
- 18. Achene margins thin or prominently calloused; heads 3-7 mm high, 4-8 mm wide, but may be wider in *P. turneri*; Sierra Madre Occidental, Mexico, and foothills, and Arizona, except *P. microglossa* widespread. 22.
- 22. Achenes 1.8-3.5 mm long; pappus bristles 2 (3), 1.5-3 mm long. 23.
- 23. Leaves deltoid-ovate to ovate-rhombic, the margins serrate,

- shallow-lobed, or serrate-crenate;
central Arizona. . . . 11. *P. ciliata*.
23. Leaves ovate to subspathulate and
entire to shallow-lobed, or ovate-
cordate and serrate to serrate-
lobed, or 2-3-pinnatifid to pedately
divided; southern Arizona and
Mexico. 24.
24. Leaves entire, shallow-lobed
or serrate; Durango, Mexico.
. 13. *P. hofmeisteria*.
24. Leaves pinnatifid or pedately
divided with spathulate or
linear segments; southern
Arizona and adjacent Mexico.
. 25.
25. Capitulescence of several
heads clustered on short
peduncles; achene mar-
gins typically long-ciliate.
. . . . 12. *P. coronopifolia*.
25. Capitulescence essentially
of solitary heads; achene
margins merely puberu-
lent. 10. *P. canescens*.
22. Achenes 1.3-2 mm long; pappus bris-
tles 2 (or 0-2), 0.5-1.5 mm long. . . 26.
26. Leaves pinnately 3-5 divided, the
divisions linear or nearly so.
. 7. *P. lineariloba*.
26. Leaves otherwise. 27.
27. Heads 0.7-1.4 cm wide.
. 6. *P. turneri*.
27. Heads 4-7 mm wide. . . . 28.
28. Plants suffrutescent per-
ennials; leaves densely
grayish-puberulent. . . .
. . . . 8. *P. microcephala*.

28. Plants delicate or robust annuals; leaves puberulent, glandular-puberulent, or glabrous. 29.
29. Ligules 1.5-3.5 mm long; upper peduncles usually copiously glandular-puberulent.
 . . 9a. *P. microglossa*
 var. *microglossa*.
29. Ligules 3.5-4.5 mm long; upper peduncles usually sparsely to densely puberulent, rarely moderately glandular-puberulent.
 . . 9b. *P. microglossa*
 var. *saxosa*.

1. **Perityle crassifolia** Brandeg. Proc. Calif. Acad. II, 3: 147. 1891. TYPE: **Mexico:** BAJA CALIFORNIA: San Jose del Cabo, 6 Oct. 1890, *T. S. Brandege* (Holotype, UC; isotypes, GH!, US(2)!).

1a. **Perityle crassifolia** var. **crassifolia**.

Plants perennial, 10-75 cm high, younger plants with slender taproots, older plants with fleshy-woody taproots, younger plants erect and branching toward the top, older plants branching at the base, tending to be decumbent, stems pilose-villous to hirsute and glandular-pubescent; leaves mostly alternate, felty to touch, arachnoid-villous to short pilose-hirsute and glandular-pubescent, 2-3 (5) cm long, 1.5-2.0 (3.0) cm wide, reniform to cordate in outline, thick and crisped, crenate to 3-5 lobed or dissected; subsessile to petiolate, the petioles 0.5-2.0 cm long; capitulescence of 1-3 heads borne on peduncles 1-4 (6) cm long; heads radiate, ca. 1.0 cm high, 1.0-1.5 cm wide, involucre hemi-

spherical; bracts numerous, ovate-lanceolate; ray flowers 12-16, ligules white, 6-8 mm long often pinkish-tinged, oblong to elliptic or subspathulate; disc flowers numerous, corollas yellow, 3.0-3.5 (4.0) mm long, throats tubular-funnelform; achenes 2.5-3.0 (4.0) mm long, lanceolate-obovate and curved, callous margins absent or very thin, the margins densely ciliate, ray achenes 3-angled and pubescent on faces, disc achenes 2-angled and glabrous on faces; pappus of a short crown of squamellae and 1 (rarely 2) slender, barbellate bristle, 2-3 mm long, the distal barbs retrorse; chromosome number, $n = 19$.

Apparently restricted to deep coastal sand from Punta Arena to San Jose del Cabo, Cape Region of Baja California Sur, and Isla Coronados. Flowering year around. (Fig. 1).

REPRESENTATIVE SPECIMENS:

Mexico: BAJA CALIFORNIA SUR: Los Frailes, S of Cabo Pulmo, *Arnaud* (DS); San Jose del Cabo, *Brandegge* (DS, GH, NY); SW end of Isla Coronados, *Carter* 4274 (DS, SD, UC, US); Punta Frailes, *Dawson* 1140 (US); 3 mi N of Los Frailes, *Hastings and Turner* 64-279 (ARIZ); sand near shore, Isla Coronados, *Moran* 9121 (SD, US); 0.5 mi E of Eureka, *Powell and Turner* 1849 (SRSC, TEX); San Jose del Cabo, *Purpus* 444 (US) 274, 446 (UC); 0.6 mi S of Buena Vista, *Wiggins* 14747 (CAS, DS, GH, TEX).

This taxon is best distinguished from var. *robusta* by its arachnoid-villous pubescence, distinct perennial habit with fleshy to woody taproots in older plants, and habitat in coastal sand.

Some considerations suggest that var. *crassifolia* and var. *robusta* should be accorded specific rank. Plants from one collection of var. *crassifolia* (*Powell and Turner* 1849) and several collections of var. *robusta* have been grown from seed under identical greenhouse conditions. The characteristic morphologies of both taxa persisted under artificial conditions, but var. *crassifolia* flowered rarely while var. *robusta* flowered profusely. Vigorous intervarietal hybrids were obtained, but only two flowering heads were produced on only one of several plants. Meiosis was regular and pollen stainability was ca. 3%. The reproductive data are

too meager to allow speculation about relationships. Also, I have seen specimens of var. *robusta* (among borrowed material) which approach var. *crassifolia* morphologically. I believe that it is best to retain varietal status for the taxa, following Everly (1947), pending populational study of the habit and habitat of var. *crassifolia*.

1b. **Perityle crassifolia** var. **robusta** (Rydb.) Everly, Contrib. Dudley Herb. 3: 382. 1947.

Perityle robusta Rydb. N. Amer. Fl. 34: 16. 1914. TYPE: **Mexico**: BAJA CALIFORNIA: Cerralvo Island, 19 April 1911, J. N. Rose 16880 (Holotype, NY!; isotype, US!; isotype fragments UC (2) !).

Perityle incompta Brandeg. Univ. Calif. Pub. Bot. 6: 503. 1919. TYPE: **Mexico**: BAJA CALIFORNIA: Los Dolores, W. E. Bryant (UC!).

Perityle macromeres Blake, Proc. Biol. Soc. Wash. 37: 59. 1924. TYPE: **Mexico**: BAJA CALIFORNIA: La Paz 3 Feb 1906, E. W. Nelson and E. A. Goldman 7483 (US!).

Plants perennial or annual, with fleshy taproots to slender branching roots, erect with few branches to spreading in large clumps with many branches, stems short-hirsute to glabrous; leaves densely short-hirsute and glandular-pubescent to glabrous, 2-10 cm long, 1-7 cm wide, ovate to cordate in outline, rather thick and crisped to thin and not crisped, typically deeply 3-5 lobed with the lobes also indented or with somewhat irregularly dissected margins; heads 0.6-1.0 cm high, 0.6-1.5 cm wide, involucre hemispherical to campanulate; ligules 6-10 mm long; disc corollas 2-3 (4) mm long; pappus bristle usually 1, rarely 0-3; chromosome number, $n = 19, 18$.

Growing in various soils, including those which are sandy or saline near the sea and occasionally among rocks, rather common in southern Baja California Sur and neighboring islands. Flowering year around. (Fig. 1).

REPRESENTATIVE SPECIMENS:

Mexico: BAJA CALIFORNIA SUR: Isla Espiritu Santo, *Berry* (CAS); Isla Magdalena, *Brandeg* (NY, UC, US); Isla Santa Margarita,

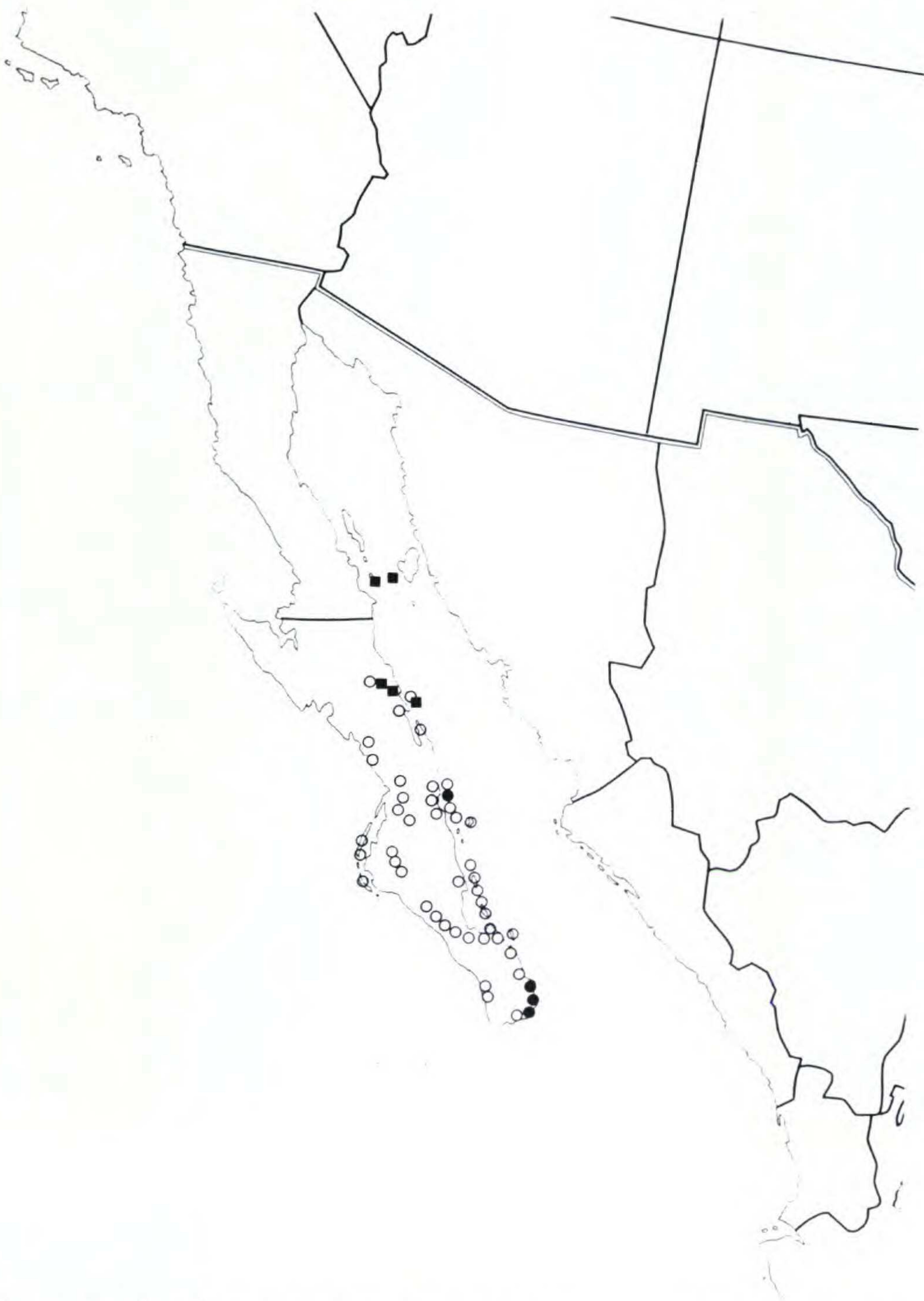


Fig. 1. Distribution of *P. crassifolia* var. *crassifolia* (closed circles); *P. crassifolia* var. *robusta* (open circles); *P. aurea* (closed squares); not plotted are *P. socorroensis* of the Revillagigedo Islands, and *P. incana* of Guadalupe Island.

Brandeggee (UC, US); San Jose del Cabo, *Brandeggee* (POM); El Mogote Peninsula, La Paz Bay, *Carter* 2729 (CAS, DS, GH, UC, US); 4.5 km N of El Refugio, *Carter, Alexander, and Kellogg* 2152 (DS, UC, US); Puerto Escondido, *Carter and Kellogg* 2875 (ARIZ, DS, GH, SD, UC, US); Isla Partida, *Collins, Kearney, and Kempton* 166 (US); Isla San Francisco, *Collins, Kearney, and Kempton* 198 (US); 10 mi W of Comondu, *Gentry* 4083 (ARIZ, DS, GH, UC); dunes, San Nicholas Bay, *Johnston* 3720 (CAS, GH, UC, US); Isla Coronados, *Johnston* 3756 (CAS, DS, GH, NY, UC, US); dunes, Isla Monserrate, *Johnston* 3865 (CAS, GH, UC, US); beach, Agua Verde Bay, *Johnston* 3893 (CAS, GH, NY, UC, US); dunes, Isla San Francisco, *Johnston* 3946 (CAS, DS, GH, NY, UC, US); Isla Cerralvo, *Johnston* 4046 (CAS); Isla Espiritu Santo, *Johnston* 4081 (CAS, GH, NY, UC, US); Guadalupe Point, Concepcion Bay, *Johnston* 4150 (CAS, DS, NY, UC); E base of San Lazaro, Santa Maria Bay, *Moran* 3537 (DS, UC); Ensenada de los Muertos, *Moran* 3560 (DS, SD); S end of Isla Cerralvo, *Moran* 3616 (DS, UC); Isla San Jose, *Moran* 3751 (DS, UC); Isla San Marcos, *Moran* 3948 (DS, UC); Isla Danzante, *Moran* 9209 (DS); W side of Isla Catalina, *Moran* 9329 (SD, UC); NE side of Isla San Jose, *Moran* 9387 (SD); Isla Las Animas Rock, *Moran* 9433 (SD, UC, US); Isla San Diego, *Moran* 9593 (SD); Isla Carmen, *Palmer* 1 (GH, NY, US); 10 mi N of Loreto, *Powell and Sikes* 1662 (SRSC, TEX); 2 mi NE of La Paz, *Powell and Sikes* 1681 (SRSC, TEX); 33 mi W of San Javier, *Powell and Turner* 1847 (SRSC, TEX); Isla Magdalena, *Rose* 16319 (NY, US); Isla Pichilique, *Rose* 16529 (GH, NY, US); 8 mi W of San Miguel, *Shreve* 7125 (ARIZ, DS, GH, US); 17 mi N of La Paz, *Sikes and Babcock* 270 (SRSC, TEX); 2 mi S of Villa Constitucion, *Sikes and Babcock* 276 (SRSC, TEX); ca. 29 mi N of Villa Constitucion, *Thomas* 8403 (CAS, DS, GH, US); 9 mi E of San Ignacio *Wiggins* 11360 (CAS, DS, GH, UC, US); San Gregoria, 12 mi NW of La Purisima, *Wiggins* 11467 (DS, GH, UC); 0.6 mi S of Buena Vista, *Wiggins* 14748 (CAS, DS, TEX, UC); Salino Flat, near S end of Isla Espiritu Santo, *Wiggins* 15595 (DS); Isla Partida, *Wiggins* 16160A (DS).

Perityle crassifolia var. *robusta* is more widespread than is var. *crassifolia*, and occupies a variety of edaphic conditions in coastal, insular, and inland areas in the southern portion of Baja California Sur. Two extreme forms of the morphologically variable var. *robusta* can be recognized. The plants of coastal habitats (e.g., near La Paz) usually are robust with fleshy, perennial taproots, while plants of the inland forms (e.g., near Comondu) are typically smaller with annual or weak perennial habits. Also, the inland form tends to be less pubescent and has thinner, less

crisped leaves than coastal plants. According to my interpretation, the "inland form" corresponds to *P. incompta* which Everly (1947) recognized as a distinct species. The "coastal form" conforms with Everly's *P. crassifolia* var. *robusta*. Although the extremes of coastal and inland forms are evident, the existence of separate taxonomic entities has not been indicated. Instead, examination of exsiccata material and field studies have shown a rather complete morphological intergradation (e.g. Johnston 3946) between the two extremes. Hence *P. incompta* is treated here as synonymous with var. *robusta*.

Further study is needed to clarify the adaptable habit of var. *robusta*, i.e., the perennial vs. annual conditions. Also, particular attention should be given to the habitats in which life forms occur. Those plants at La Paz grow in crusty saline soils, while plants of other populations may be in crevices of granite rocks, in rocky soil, or in fine sand.

Another aspect of variability in var. *robusta* is presence or absence of pappus bristles, which seemingly is not taxonomically significant. As a generality, however, awnless forms occur on islands while awned forms are peninsular, but there are exceptions.

2. *Perityle socorrensis* Rose, Bot. Gaz. 15: 118. 1890. TYPE: **Mexico:** Socorro Island, Revillagigedo Islands, Mar. 1889, C. H. Townsend (Holotype, US!; isotypes, GH!, NY!, US!).

Plants suffruticose perennials, 10-40 cm high, many branched and densely leafy; leaves typically alternate, densely short-hirsute and glandular-pubescent, semisucculent, 2-6 cm long, 0.8-3.0 cm wide, ovate, deltoid-ovate, cordate to subhastate, 3-5 shallow-lobed and serrate to crenate; petioles 1.5-3.0 cm long; capitulescence of 1-2 (3-5) heads borne on peduncles 1.0-3.5 (6.0) cm long; heads typically radiate, rarely discoid, ca. 6 mm high, 7-10 mm wide, involucre campanulate to narrowly so; bracts lanceolate to oblanceolate or oblong-lanceolate; ray flowers ca. 10 or fewer, ligules white, 2-4 mm long, oblong to oblong-elliptic, rarely with a prominent inner lobelet; disc corollas yellow

(?), 2.0-2.5 mm long, throats tubular-funnelform; achenes 2.2-3.0 mm long, oblanceolate-obiconical, oblong-oblanceolate, to narrowly obconical typically curved, callous margins absent or very thin, the margins ciliate, ray achenes sparsely and minutely pubescent on faces, disc achenes glabrous or nearly so; pappus of a short to vestigial crown of squamellae and typically 2 (0-1) bristles, 1.5-2.0 mm long, the bristles retrorse barbellate (rarely lateral or antorse) distally; chromosome number, $n = 19$.

Endemic to the Revillagigedo Islands, growing on sea cliffs and in soils near the shore. Flowering mostly in winter and spring.

REPRESENTATIVE SPECIMENS:

Mexico: REVILLAGIGEDO ISLANDS: Isla San Benedicto: *Anthony* 372 (CAS, DS, GH, NY, UC, US); *Barkew* 175 (ARIZ, DS, GH, NY, POM, UC, US); *Mason* 1684 (CAS, GH, UC, US); Isla Clarion: *Anthony* 415 (CAS, DS, POM, UC, US); Sulfur Bay, *Howell* 8347 (CAS, DS, NY, POM, US); W end of island, *Mason* 1578 (CAS, DS, GH, NY, POM, UC, US); Isla Socorro: *Anthony* 383 (ARIZ, CAS, DS, GH, POM, SD, UC, US); *Barkew* 192 (ARIZ, DS, GH, NY, POM, UC, US); Academy Bay, *Carlquist* 368 (CAS, RSA, UC); Brenner's Cove, *Howell* 8423 (CAS, DS, GH, UC, US); Graysons Cove, *Moran* 5922 (ARIZ, CAS, DS, GH, NY, RSA, SD, UC, US).

Perityle socorrensis is a distinct species closely related to *P. crassifolia* from which it is distinguished by its typically 2 pappus bristles, reduced squamellae, generally smaller floral features, short ligules (or absent), woody bases, leaf morphology, and its distribution.

As discussed by Everly (1947), *Perityle socorrensis* is notably variable in ligule and pappus features. The ligules, typically short at 2-4 mm, are even shorter and aberrant-looking in many collections, while other specimens are without ligules. According to label data, discoid individuals may occur in populations with radiate forms, and thus no taxonomic significance is attributed to ligule variability. Typically, the number of pappus bristles per achene in *P. socorrensis* is two, but some individuals or populations may have only one bristle or none. Bristle number is correlated

with the island to island distribution: plants with two bristles on Socorro and San Benedicto Islands, and awnless forms on Clarion Island. No taxonomic significance is attached to bristle variability since exceptions are found on all the islands, and because other features are not correlated with the pappus differences.

3. **Perityle emoryi** Torr. in Emory, Notes Mil. Rec. 142. 1848. TYPE: **California**: mountains E of San Diego, 29 Nov. 1846, *Emory* (NY!).

Perityle nuda Torr. Pacif. R. Rep. 4: 100. 1857. TYPE: **California**: Williams' River, 7 Feb. 1853-4, *J. M. Bigelow* (NY!).

Perityle emoryi var. *nuda* A. Gray, Bot. Calif. 1: 397. 1876.

Perityle emoryi S. Wats. Proc. Amer. Acad. 11: 116. 1876. Not *P. emoryi* Torr. 1848.

Perityle californica A. Gray, Syn. Fl. N. Amer. 1: 321. 1884. Not *P. californica* Benth. 1844.

Perityle californica var. *nuda* A. Gray, Syn. Fl. N. Amer. 1: 321. 1884.

Perityle fitchii var. *palmeri* A. Gray, Syn. Fl. N. Amer. 1: 321. 1884.

Perityle fitchii Green, Bull. Calif. Acad. 2: 403. 1887. Not *P. fitchii* Torr. 1857.

Perityle californica Vasey, Proc. U. S. Nat. Mus. 11: 368. 1889. Not *P. californica* Benth. 1844.

Perityle rothrockii Rose, Bot. Gaz. 15: 114. 1890. TYPE: **Nevada**: 1872, *Wheeler* (US!).

Perityle greenei Rose, Bot. Gaz. 15: 117. 1890. TYPE: **California**: Santa Cruz Isl., July-Aug. 1886, *E. L. Green* (Holotype, ND?; isotypes, DS!, NY!, UC!, US!).

Perityle emoryi var. *orcuttii* Rose, Bot. Gaz. 15: 117. 1890. TYPE: **Mexico**: BAJA CALIFORNIA. Canyon Cambellos(?) July, 1884, *C. R. Orcutt* (Holotype, US!; isotype GH!).

Perityle grayi Rose, Bot. Gaz. 15: 118. 1890. TYPE: **Mexico**: Guadalupe Isl., 1875, *E. Palmer* 44 (Holotype, US?; isotypes, GH!, NY!).

Laphamia nuda Benth & Hook. ex Jacks. Ind. Kew. 2: 30. 1895.

Laphamia emoryi Benth & Hook, ex Jacks. Ind. Kew. 2: 30. 1895. Partial Synonymy of South American *P. emoryi* (= *Closia*).

Closia elata Phil Fl. Atac. 31 and Viage Des. Atac. 19, 205. 1860. Type not examined.

Closia discoidea Phil. Fl. Atac. 31 and Viage Des. Atac. 205. 1860. Type not examined.

Perityle emoryi Torr. var. *elata*. (Phil.) I. M. Johnston, Contr. Gray Herb. 85: 127. 1929.

Perityle discoidea (Phil.) I. M. Johnston, Contr. Gray Herb. 85: 128. 1929.

Plants delicate or robust annuals, 2-60 cm high, usually herbaceous or the lower stems woody, erect or spreading with few to many stems, puberulent to hirsute and glandular-pubescent; leaves mostly alternate, hirsute to glandular-pubescent, 2-10 cm long 1-5 cm wide, ovate, cordate, sub-orbicular, to triangular in outline, the margins deeply toothed, lobed, cleft, or divided, with the segments also indented to irregularly dissected; petioles 0.3-4.0 cm long; capitulescence of 1 to many heads borne on peduncles 0.1-7.0 cm long; heads radiate (rarely discoid), 0.4-1.0 cm high, 0.4-1.0 cm wide; involucre hemispherical or campanulate; bracts numerous, lanceolate, oblanceolate, to ovate-lanceolate; ray flowers 8-12 (14), ligules white, usually oblong, 1.5-4.0 (6.0) mm long, 1.5-3.0 mm wide, rarely rudimentary; disc flowers numerous, corollas yellow, 2.0-2.5 (3.8) mm long, throats tubular to tubular-funnelform; achenes (1.5) 2-3 mm long, suboblong, oblanceolate, or subcuneate, the outer ones often curved, margins thin, not calloused, the margins long- or short-pubescent (ciliate), outer achenes 2-3 (4) angled and often pubescent on the faces, inner achenes 2-angled with glabrous (rarely puberulent) faces; pappus of a vestigial or conspicuous crown of squamellae and 1 slender bristle, (0.8) 1.0-2.5 (3.5) mm long, antrorse-, lateral-, or retrorse-barbed especially at the tip,

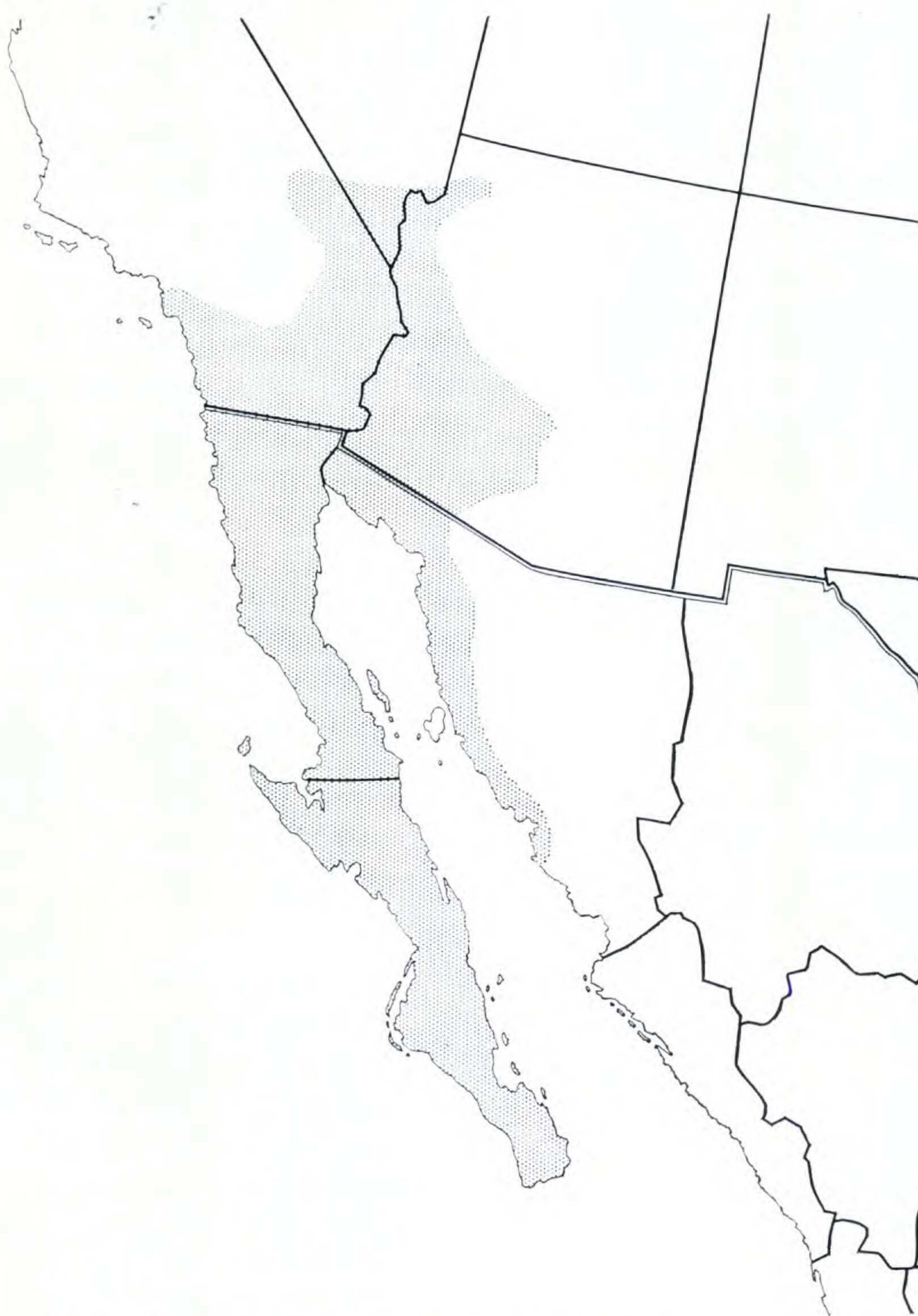


Fig. 2. Generalized distribution of *P. emoryi* (stippled); South American distribution in Chile and Peru not plotted.

or the bristle absent; chromosome number, tetraploid ($n = 32-36$) or hexaploid ($n = 50-58$).

Widespread weed of desert southwestern United States, Sonora, Mexico, Baja Californian peninsula, and neighboring islands; continental disjunct in Chile and Peru. Flowering mostly in winter and spring, but also year around, depending upon latitude. (Fig. 2).

REPRESENTATIVE SPECIMENS:

MEXICO: Baja California: Ensenada, *Anthony* 180 (CAS, DS, UC, US); 8.2 mi S of Socorro, *Constance* 3119 (DS, GH, LL, UC, US); Bahia de los Angeles, *Cowan* 2265 (TEX); 14 mi S of Santa Rosalilita, *Powell and Sikes* 1647 (SRSC, TEX); 41.6 mi S of Mexicali, *Powell and Turner* 1710 (SRSC, TEX); Arroyo Calmalli, *Purpus* 23 (CAS, NY, POM); 14 km NW of Colonia Guerrero, *Raven, Lewis, and Thompson* 12193 (GH); 8.5 km E of El Rosario, *Raven, Mathias, and Turner* 12433 (ARIZ, GH); 15.9 mi N of San Felipe, *Raven* 14775 (DS, UC); N side of El Arco, *Sikes and Babcock* 295 (SRSC, TEX); 2 mi N of Mission de San Borja, *Wiggins and Wiggins* 14851 (DS); 9 mi S of Puertocito, *Wiggins and Wiggins* 15877 (DS, US). **Baja California Sur:** Sierra de la Trinidad, Cape Region, *Brandeggee* (UC, US); near Santa Rosalia, *Ferris* 8702 (DS); Santo Domingo, *Gander* 9792 (SD); 10 mi W of Comondu, *Gentry* 4083 (ARIZ, UC); San Francisquito Bay, *Johnston* 3566 (CAS, GH, US); Concepcion Bay, *Johnston* 4150 (GH, US); E base of San Lazaro, Santa Maria Bay, *Moran* 3537 (SD); 13.6 mi. S of Mulege, *Powell and Turner* 1836 (SRSC, TEX); ca. 20 mi N of Santa Rosalia, *Sikes and Babcock* 285 (SRSC, TEX); 3 mi NW of San Ignacio, *Sikes and Babcock* 288 (SRSC, TEX); San Ignacio, *Wiggins* 16233 (DS); 3 mi N of El Barril, *Wiggins* 16864 (DS); Mulege, *Wiggins and Wiggins* 18070 (US); 4 mi S of El Arco, *Wiggins and Wiggins* 18191 (CAS, DS). **Islands:** ISLA ANGEL DE LA GAURDA: *Wiggins* 17010 (DS). ISLA CARMEN: *Moran* 9181 (SD). ISLA CEDROS: *Anthony* 283 (CAS, DS, GH, NY, POM, UC, US); *Haines and Hale* (CAS, GH, LL, NY, SD, UC, US); *Howell* 10684 (CAS, DS, GH, NY, POM, US). ISLA CORONADOS: *Moran* 6556 (SD); *Palmer* 16 (GH, NY, US). ISLA GUADALUPE: *Anthony* 233 (CAS, DS, GH, UC, US); *Carlquist* 439 (RSA); *Mason* 1502 (CAS, GH, US); *Moran* 2900 (DS, GH), 5628 (DS, RSA, SD, UC); *Palmer* 891 (NY, UC, US); *Rose* 16003 (GH, NY, US). ISLA ILDEFONSO: *Moran* 9062 (SD); *Wiggins* 18254 (CAS, DS). ISLA NATIVIDAD: *Brandeggee* (UC); *Moran* 10797 (SD). ISLA PARTIDA: *Johnston* 3235 (CAS, US); *Wiggins* 17268 (DS). ISLA PARTOS: *Johnston* 3240 (CAS, GH, NY, UC, US). ISLAS REVILLAGIGEDO: *Mason* (CAS, US). ISLA SALSIPUEDES: *Moran* 8871 (SD, US). ISLA SAN BENITO: *Anthony* 271 (DS, GH, POM, UC); *Palmer* 914 (ARIZ, CAS,

DS, NY, US). ISLA SAN ESTEBAN: *Wiggins* 17218 (DS). ISLA SAN LORENZO: *Moran* 8895 (SD). ISLA SAN MARCOS: *Johnston* 3622 (CAS, GH, UC, US). ISLA SAN PEDRO MARTIR: *Johnston* 3148 (CAS, GH, UC, US); *Moran* 8810 (SD). ISLA TIBURON: *Johnston* 3268 (CAS, US). ISLA TODOS SANTOS: *Moran* 16214 (SD). ISLA TORTUGA: *Wiggins* 17367 (DS). **Sonora:** Puerto Penasco, *Breedlove* 1397 (DS); 27.4 mi S of Sonoyta, *Breedlove* 1389 (DS, TEX); vicinity of Libertad, *Graham* 3803 (DS); 3 mi W of Kino, *Heckard* 1575 (JEPS); 1 mi E of San Carlos Resort, *Powell and Sikes* 1685 (SRSC, TEX); Empalme, *Rose, Standley, and Russell* 12636 (GH, NY, US); 5 mi NW of Caborca, *Shreve* 7532 (ARIZ); 4 mi NW of Caborca, *Wiggins* 8233 (DS, GH, UC, US).

U.S.A.: **Arizona:** COCONINO CO.: Havasu Canyon, Grand Canyon, *Howell* 26537 (ARIZ, CAS, SMU); GILA CO.: Roosevelt Dam, *Eastwood* 6247A (CAS). MARICOPA CO.: Phoenix, *Eastwood* 6159 (CAS); near Tempe, *Gillespie* 8808 (DS, GH, POM, UC, US); 2 mi NW of Scottsdale, *Russell* 10911 (SMU, UC). MOHAVE CO.: 7 mi NW of Alamo, *Benson* 10074 (POM); 3.4 mi SE of Boulder Dam, *Carter and Chisaki* 3230 (ARIZ, DS, LL, NY, RSA, SMU, UC, US); Toroweap, Grand Canyon, *Cottam* 13001 (UT); 62 mi N of Wickenburg, *Sikes* 106 (SRSC). PIMA CO.: 10 mi W of Bates Well, Growler Mts., *Benson* 9926 (POM); Gunsight Peak, *Fosberg* 7865 (POM); ca. 5 mi N of Ajo, *Gould and Macbride* 4130 (ARIZ, GH, NY, UC); Alamo Canyon, Ajo Mts., *Huey* 24351 (GH, SD); Dripping Spring, Organ Cactus Natl. Mon. *McClintock* 52-37 (CAS). PINAL CO.: Sacaton, *Gilman* 350 (ARIZ); 10 mi W of Maricopa, *Russell* 11343 (SMU). YUMA CO.: Gila Mts., near US 80, *Barr and Lange* 64-174 (ARIZ); S end of Castle Dome Mts., *Parker, Wright and Lowe* 7789 (ARIZ, DS, NY, RSA, US); 15.6 mi E of Yuma, *Powell and Turner* 1704 (SRSC, TEX); S end of Cunningham Pass, Harcuvar Mts., *Wiggins* 8452 (DS, GH, UC, US). **California:** IMPERIAL CO.: 8 mi from Niland to Blythe, *Balls* 12921 (RSA); 7 mi N of All American Canal spillway, *Wiggins* 8613 (DS, NY, POM, UC, US). INYO CO.: Furnace Creek, Death Valley, *Carpenter* (JEPS); Funeral Mts., *Coville and Funston* 324 (US); Hanaupah Canyon, *Coville and Gilman* 392 (US); Darwin Falls, *Hitchcock* 6219 (UC); Surprise Canyon, *Howell* 3964 (CAS); Panamint Valley *Smith* 86 (JEPS). KERN CO.: Last Chance Canyon, El Paso Range, *Twisselman* 11863 (JEPS). LOS ANGELES CO.: Santa Catalina Isl., *Brandegge* (UC); Santa Monica Mts., *Epling* (DS, NY, RSA); Anacapa Isl., *Howell* 3816 (JEPS); San Clemente Isl., *Raven* 17345 (RSA, UC). RIVERSIDE CO.: Palm Springs, *Abrams* 11012 (DS); San Jacinto Range, *Benson* 4167 (POM); 8 mi NE of Desert Center, *Wiggins* 9675 (DS, GH, RSA, UC). SAN BERNARDINO CO.: 29 Palms, *Alexander and Kellogg* 870 (UC); near Parker Dam, *Brenckle* 51140 (SMU, UC); 39 mi N of Needles, *Ferris* 7224 (DS); between Kelso and Baker, *Jepson* 20590 (JEPS). SAN DIEGO CO.: 23.1 mi NW of Coyote Wells, *Breedlove* 1856 (DS);

Yaqui Wells, *Eastwood* 2644 (CAS, GH, UC, US); Jacumba, *Nelson* 11182A (DS, GH, NY, POM, UC); Borego Park, *Wolf* 8462 (ARIZ, GH, NY, RSA). SANTA BARBARA CO.: Santa Cruz Isl., *Balls and Blakley* 23727 (RSA, UC). VENTURA CO.: Point Mugu, *Howell* 3733 (CAS). Nevada: CLARK CO.: between Las Vegas and Boulder Beach, *Cronquist* 9844 (NY, UC); 1 mi below Boulder Dam, *Grater* 51 (UC); 8 mi SW of Davis Dam, *Gullion* 258 (UC).

CHILE: Atacama: Chanaral, *Beetle* 26164 (GH, UC); vicinity of Caldera, *Gigoux* (GH); below Agua El Huerto, *Johnston* 3678 (US); vicinity of Potrerillos, *Johnston* 4740 (GH, US); vicinity of Puerto de Chanaral, *Johnston* 4794 (GH, US); vicinity of Copiapo, *Johnston* 5023 (GH); Caldera, *Johnston* 5056 (GH); vicinity of Caleta Pan de Azucar, *Johnston* 5829 (US); Vallenar, *Werdermann* 160 (GH); Tierra Amarilla, *Werdermann* 406 (GH, NY); Quebrada Paipote, *Werdermann* 448 (GH, NY). Antofagasta: Taltal, *Jaffuel* 984 (GH); Tocopilla, *Jaffuel* 1014 (GH); Antofagasta, *Jaffuel* 1126 (GH); 6 km N of Puerto Tocopilla, *Johnston* 3585 (US).

ECUADOR: Galapagos Isles: Cerros Isl., *Stewart* 40 (CAS).

PERU: Mts. near Chosica, Lima-Oroya Railroad, *Weberbauer* 5320 (GH, US).

The morphological variation of *Perityle emoryi* is attested to by its considerable synonymy. This widespread annual, polyploid weed exhibits variation in nearly all aspects of plant form. I have carefully examined the bulky exsiccatae available to me, giving particular attention to plant size, leaf morphology, head size, presence or absence of ligules and pappus bristles, and geographic distributions. None of the variable morphological aspects appear to have populational significance, and thus, in my judgement, do not require taxonomic recognition. I do note, however, that several atypical collections of *P. emoryi* from Magdalena Island resemble *P. crassifolia* and *Amauria brandegeana*, and thus the desirability of further study of *Perityle* from this locality is indicated.

Perityle emoryi is related to and probably derived from the diploid *P. crassifolia* var. *robusta*, from which it is delimited by habit, smaller heads, shorter ligules, usually shorter disc corollas, and chromosome number. With poorly preserved specimens it is often difficult to distinguish these taxa, but I have not had difficulty recognizing them in the field. *Perityle emoryi* is also remarkably similar to *Amauria*

brandegeana in superficial morphology. A discussion of the later similarity and distinguishing traits is to be found elsewhere (Powell, 1972a).

It is assumed that *P. emoryi* achieved wide distribution as a result of the increased adaptability provided through a combination of polyploidy, reproductive self-compatibility and annual habit. That polyploids often exceed their diploids in distribution is well-known (Stebbins, 1950), and the advantage of self-compatibility in the establishment of disjunct colonies is clear. Indeed, Raven (1963) has suggested that *P. emoryi* might have attained bicontinental distribution as a result of long-distance dispersal from the Sonoran Desert, and he indicated the advantage of self-compatibility to such long-distance dispersal. More specifically, I believe that the South American *P. emoryi* originated from the vicinity of southern Baja California. It is in southern Baja California that the ancestors of *P. emoryi* are found. Furthermore, geographic variation in length of pollen spines (the spines ornamenting pollen walls) suggests that South American and Mexican *P. emoryi* had common areal origin. In measuring the pollen spines of some 20 populations of *P. emoryi*, it was found that the spine length of South American populations averaged the same or slightly longer than that of Mexican populations, while the spine length of United States populations was nearly twice as short as the others (Powell & Miller, unpublished). From this information it can be postulated that *P. emoryi* originated and became established in Baja California, migrated to South America by long-distance dispersal in late Pliocene or Pleistocene (Raven, 1963), and subsequently advanced to the north, occupying desert areas in southwestern United States.

Further study of the South American *Perityle emoryi* is needed, particularly chromosomal analyses and living plant comparisons. At least two forms can be recognized among the South American specimens I have seen, and this was discussed to some extent by Johnston (1929). One form (= *P. discoidea* (Phil.) I. M. Johnst.) deviates from North

American *P. emoryi* in smaller habit, numerous, smaller and tightly clustered heads with no conspicuous ligules, and a pappus bristle on the achenes. Another form (= *P. emoryi* var. *elata* (Phil.) I. M. Johnst.) is variable in habit, has large and small heads, longer and short ligules, and awnless achenes. I have not been able to make taxonomic distinctions between the South American and North American forms, pending further study, and thus have placed Johnston's combinations in synonymy. It should be noted that only a partial synonymy of South American *P. emoryi* (*Closia*, in part?) is included since I have not seen specimens or types upon which several other *Closia* names are based. A few other collections from South America closely resemble *P. crassifolia* (e.g., Johnston 5023) or *Amauria brandegeana* (e.g., Werdermann 160; Morong 93). As mentioned above, these similarities are also seen in a few Mexican specimens. But it is also possible that both *P. crassifolia* and *Amauria brandegeana* once made their way to South America even though they have not become established there.

4. **Perityle aurea** Rose, Contr. U. S. Nat. Herb. 1: 84. 1890. TYPE: **Mexico:** BAJA CALIFORNIA: Santa Rosalia, 24 Feb.-3 Mar. 1889, E. Palmer 185a (Holotype, US!; isotypes, CAS!, GH!, NY!).

Plants annual, 10-60 cm high, erect or spreading, stems of larger plants succulent, reddish, nearly glabrous; leaves alternate, puberulent to glabrous, slightly thick in texture, 1.7-9.0 cm long, 1-4 cm wide, subreniform to ovate in outline, basically 3-lobed with dentate-serrate lobes and margins; petioles 0.6-5.0 cm long; capitulescence of 1-3 heads borne on rather short peduncles 1-2 (3) cm long; heads radiate, 5-8 mm high, 5-8 mm wide, involucre campanulate to narrowly so; bracts broadly lanceolate; ray flowers ca. 10, ligules yellow, oblong-elliptic to obovate; disc corollas yellow, 2-3 mm long, throats tubular to funnelform; achenes 2-3 mm long, narrowly oblanceolate to suboblong, with thin callous margins, the margins densely white-ciliate, ray achenes pubescent on faces, disc achenes glabrous or nearly

so on faces, pappus of a conspicuous crown of squamellae and 1 bristle (rarely 0) 1.5-2.5 mm long, the bristle retrorse barbelate with few barbs at tip; chromosome number, $n = 17$.

Restricted in soils and among rocks, near Santa Rosalia of Baja California Sur and a few islands in the Sea of Cortez. Flowering Jan-April. (Fig. 1).

SPECIMENS EXAMINED:

Mexico: BAJA CALIFORNIA: summit and N slope of high peak near SE corner of Isla San Esteban, *Moran* 8845 (SD, US); summit of NE peak, Isla San Esteban, *Moran* 13044 (SD); arroyo on S Isla San Lorenzo, *Moran* 13060 (SD). BAJA CALIFORNIA SUR: Isla San Marcos, *Johnston* 3614 (CAS, GH, UC, US); Isla San Marcos, *Moran* 3965 (DS); Santa Rosalia, *Palmer* 185a, 185 (CAS, GH, US); 8 mi W of Santa Rosalia, *Powell and Turner* 1826, 1829 (SRSC, TEX); 3 mi N of Santa Rosalia, *Powell and Turner* 22219 (SRSC, TEX); 10 mi N of Santa Rosalia, *Reed* 6225 (DS, POM); ca 12 mi N of Santa Rosalia, *Sikes and Babcock* 281 (SRSC, TEX).

Two growth forms of *Perityle aurea* are evident in the field, and both have been preserved in existing collections of the species. One form is of small plants, superficially resembling the Baja California populations of *P. californica*, and the other form is of taller, more robust and succulent plants resembling *P. crassifolia*. The small form is known to occur in roadside soils where dry conditions prevail, and the large form occurs in places that receive and retain more water. The growth forms likely are ecologically controlled. I have seen both forms growing only a few paces apart, and when seeds of both plant sizes were grown under identical greenhouse conditions, only the larger, more succulent forms developed. The island specimens of *P. aurea* differ slightly from the mainland forms, most notably in achene morphology and in being awnless, although awned forms also occur on San Esteban Island.

Perityle aurea seemingly is related to *P. crassifolia*, from which it is readily delimited by yellow ligules, chromosome number ($n = 17$), and distribution. An affinity of *P. aurea* with the *P. crassifolia* alliance is not indicated by its yellow

ligules and chromosome number. All other members of the *P. crassifolia* group have white ligules and have $x = 19$. My first impression from superficial morphological examinations was that the species was related to *P. californica* ($n = 13, 12, 11$) and *P. cuneata* ($n = 16, 12$), both annual yellow-rayed taxa with habits similar to the small growth form of *P. aurea*. But *P. aurea* exhibits a combination of vegetative and floral features which characterize only the *P. crassifolia* alliance: robust and rather succulent habit, achenes with callous margins absent or thin, other unique achene morphology, and pappus bristles retrorsely barbed at the tips. Also, chromatographic studies have shown that *P. aurea*, like members of the *P. crassifolia* group, produces the abundant yellow flavonoid compounds that have been detected elsewhere in sect. PERITYLE only in the *P. parryi* group of Texas. I conclude that *P. aurea* evolved, probably from *P. crassifolia* var. *robusta*, through speciation that involved adaptation of the annual habit and aneuploid reduction in chromosome number. Artificial hybridizations have strongly suggested that the above taxa are reproductively isolated (Powell, 1972c).

5. **Perityle incana** Gray, Proc. Amer. Acad. 11: 78. 1876. TYPE: **Mexico:** BAJA CALIFORNIA: Guadalupe Island, Feb.-May, 1875, *E. Palmer* 43 (Holotype, GH!; isotypes, NY!, US!).

Nesothamnus incanus (Gray) Rydb. N. Amer. Fl. 34: 12. 1914.

Plants shrubby, 10-40 (80) cm high, many branched and densely leafy, stems tomentulose-canescens; leaves alternate, thickish, tomentulose-canescens, 6-14 cm long, 4-7 cm wide, deeply 3-divided or palmate, the divisions again deeply lobed or cleft; petioles 1.5-7.0 cm long; capitulescence of many tightly clustered heads (naked corymbs) borne on short peduncles; heads discoid, 5-7 mm high, 4-8 mm wide, involucre campanulate; bracts broadly oblong-lanceolate to broadly linear; disc corollas yellow, 2-3 mm long, throats narrowly campanulate or broadly tubular;

achenes 2.0-3.8 mm long, narrowly obdeltoid to narrowly oblanceolate, with prominent callous margins, the margins coarse-ciliate, the faces coarse-pubescent; pappus crown of 2 broad, laciniate squamellae, 0.5-0.9 mm long, and rarely a narrow, fimbriate scale, 1.0-1.2 mm long; chromosome number, $n = \text{ca. } 50-57$.

Endemic to Guadalupe Island and islets, growing on cliffs near the sea. Flowering winter, spring, and early summer.

REPRESENTATIVE SPECIMENS:

MEXICO: **Baja California:** ISLA GUADALUPE: *Anthony* 249 (DS); *Carlquist* 440 (RSA, UC); Barracks Cove, *Copp* 157 (DS); *Franceschi* 7 (A, DS, POM, UC); *Howell* 8172 (CAS); Outer Islet, *Lindsay* 2621 (SD); Islote Negro, *Mason* 1519 (ARIZ, CAS, DS, US); *Moran* 2904 (DS, RSA); Outer Islet, *Moran* 5682 (CAS, DS, NY, SD, UC); North Twin Canyon, *Moran* 6133 (SD); N end of island, *Moran* 6435 (DS, SD); cliffs of the Lower Circus, *Moran* 12023 (SD); N side of Mt. Augusta, *Moran* 12042 (DS, SD, UC); SW Oak Canyon, *Moran* 13792 (SD).

This cliff-dwelling Guadalupe Island endemic is perhaps the most distinct species of sect. PERITYLE. Its identifying features include: shrubby habit; tomentulose-canescient pubescence; clustered, naked capitulescence; coarse pubescent achenes; pappus of broad, laciniate squamellae and rarely a narrow, fimbriate scale. Considering its relatively large, shrubby habit, unique character, and isolated distribution, *Perityle incana* would seem to be a primitive member of the genus, although this possibility is not strengthened by its hexaploid chromosome number. According to Reid Moran (personal communication), the taxon is not in danger of extinction, largely because its habitat is out of reach of the goats which have overrun the island for more than a century.

It is clear that *Perityle incana* does not belong with any of the related-species groups, and thus stands as an anomalous species. In fact, the species could be recognized as a monotypic genus with little change in the taxonomic naturalness of the subtribe. I suspect, however, that the taxon is distantly related to the *P. crassifolia* group and is best

treated as a member of sect. PERITYLE. *Perityle incana* is similar to *Pericome* in habit and capitulescence characters, and perhaps shares ancestral affinity with that genus.

6. *Perityle turneri* Powell, Madroño 21: 456-457. 1972. TYPE: Mexico: DURANGO: 3.4 mi E of Ey Palmito, 2 Apr. 1970, A. M. Powell 1858 (Holotype, TEX!; isotype, SRSC!).

Plants herbaceous to suffrutescent perennials, decumbent, prostrate, or semierect, stems spreading 20-45 cm long, often purplish, lower stems often rooting at the nodes, upper stems puberulent to densely so, short-pilose, or subtomentose; leaves mostly opposite, puberulent to densely so, short-pilose to densely so, or subtomentose, often purplish, 3.0-4.5 (8.5) cm long, 1.5-3.0 (4.0) cm wide, ovate, deltoid, or subcordate, the apexes acute or attenuate, the margins serrate, serrate-crenate, serrate-lobed to doubly so, the serrations or lobes acute or acuminate; petioles 1.0-1.5 (3.0) cm long; capitulescence of 1-3 (4) heads on peduncles (1.0) 2-6 cm long; heads radiate, subglobose, 5-7 mm high, 0.7-1.4 cm wide, involucre hemispherical to broadly campanulate; receptacles conical; ray flowers ca. 12-18, ligules white, (3) 6-9 mm long, oblong; disc corollas yellow, (1.8) 2.0-2.8 (3.0) mm long, throats short-campanulate, short-funnel-form, rarely narrowly tubular-funnel-form; achenes 1.5-2.0 mm long, obovate to oblong-ovate, with thin or prominent callous margins, the margins ciliate, the faces puberulent in the center; pappus of a prominent crown of squamellae and 2 (rarely 1) unequal bristles, the longest 0.6-1.5 mm long; chromosome numbers $n = 17$, $n = 17 \text{ II} + \text{I}$.

Moist seeps and canyons, higher elevations to ca. 9500 feet, southern Chihuahua and Durango in the Sierra Madre Occidental. Flowering spring and fall. (Fig. 3).

REPRESENTATIVE SPECIMENS:

Mexico: CHIHUAHUA. 4 mi SW of Villa Matamoros, Correll and Gentry 22819 (LL); near La Rocha, NE slope of Sierra Mohinora, Correll and Gentry 23109 (LL); Burro Canyon near Parral, Pringle 13650 (ARIZ, CAS, GH, SMU, TEX, UC, US). Durango. Quebrada San Juan, ca. 50 mi W of Durango and 23 mi NW of Los Coyotes RR,

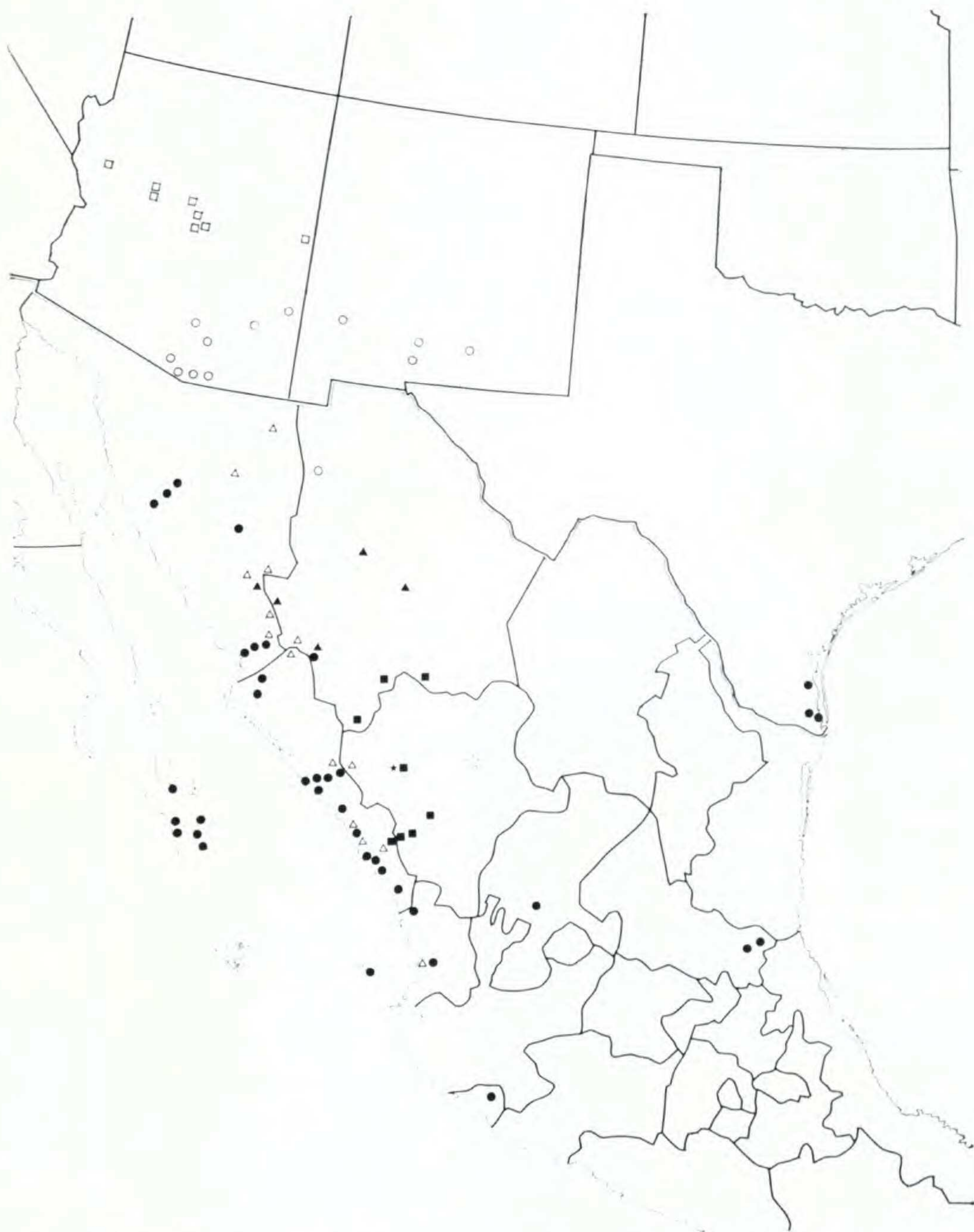


Fig. 3. Distribution of *P. turneri* (closed squares); *P. lineariloba* (closed star); *P. microcephala* (closed triangles); *P. microglossa* var. *microglossa* (closed circles); *P. microglossa* var. *saxosa* (open triangles); *P. ciliata* (open squares); *P. coronopifolia* (open circles); *P. hofmeisteria* (open star); not plotted is *P. canescens*.

Cronquist 9568 (NY, SMU, TEX, US); 2 km S of El Espinozo del Diablo, and 65 km SW of El Salto, *Cronquist and Fay* 10786 (NY); 6 mi W of La Ciudad, *Flyr* 273 (TEX); ca. 35 mi W of El Salto, *Gentry and Arguelles* 18210 (US); San Ramon, *Palmer* 60 (GH, NY, UC, US); 2.2 mi E of El Palmito, *Powell and Turner* 1857 (SRSC, TEX); 12 mi W of La Ciudad, *Sikes and Babcock* 380 (SRSC, TEX). SINALOA. 0.9 mi W of El Palmita, ca. 47 mi E of Concordia, *Breedlove* 1721 (DS).

Plants of this remarkable species were rarely collected until part of its high-altitude distributional range was made accessible by the road cut across the Sierra Madre Occidental from Durango to Mazatlan. At the type locality near Mex. 40, *Perityle turneri* is abundant in wet mats formed by dense growths of *Selaginella* and small ferns. In overall aspect, at least at the type locality, the taxon shows striking resemblance to members of the tribe Astereae.

Perityle turneri is related to *P. lineariloba*, from which it is easily delimited by leaf shape, and to *P. microcephala*, from which it can be distinguished by its capitulescence and head size. Further discussion concerning the taxonomy of this species is available elsewhere (Powell, 1972e).

7. *Perityle lineariloba* Rydb. N. Amer. Fl. 34: 18. 1914. TYPE: **Mexico:** DURANGO: San Ramon, 21 Apr.-18 May 1906, *E. Palmer* 89 (Holotype, NY!; isotypes, GH!, UC!, US!).

Plants seemingly perennial, with semi-annual roots, stems lignescent near the base, decumbent, ca. 30 cm long, grayish-puberulent above; leaves mostly opposite, finely puberulent, 2.5-6.0 cm long, 1.5-3.5 cm wide, pinnately 3-5 divided, the divisions linear or nearly so and entire or cleft into linear segments; petioles 0.7-2.0 cm long; capitulescence of solitary heads on long peduncles, 4-10 cm long; heads radiate, 5-6 mm high, 5-7 mm wide, involucre broadly campanulate; ray flowers ca. 10-15, ligules white, 4-7 mm long, oblong; disc corollas yellow (?), 1.8-2.0 mm long, throats narrowly campanulate-funnelform; achenes 1.3-1.5 mm long, narrowly obovate to oblong-obovate, with thin or prominent callous margins, the margins and faces short-pubescent; pappus of a conspicuous crown of squamellae and 1 (rarely

none) delicate bristle, ca. 0.5 mm long; chromosome number, unknown.

Known only from the type collection. (Fig. 3).

The distinguishing characteristics of *Perityle lineariloba* include its pinnately divided leaves, long peduncles, and relatively large heads with long ligules. Most of its floral features are like those of *P. turneri*, to which the species is related.

8. *Perityle microcephala* A. Gray, Proc. Amer. Acad. 21: 391. 1886. TYPE: **Mexico:** CHIHUAHUA: rocky hills near Chihuahua, 8 Oct. 1885, *C. G. Pringle* 571 (Lectotype, GH!; islectotype, US!). LECTOPARATYPE: **Chihuahua:** mountains above Batopilas, Oct, 1885, *E. Palmer* 268 (GH); islectoparatypes, NY! US!).

Plants suffrutescent perennials, 20-40 cm high, many-stemmed and densely leafy, erect or decumbent, densely grayish-puberulent to pilosulous; leaves mostly opposite, densely grayish-puberulent, 1.5-3.5 (5.0) cm long, 0.8-2.0 (3.0) cm wide, deltoid-ovate, ovate, to subcordate, the margins serrate-crenate to doubly so, or shallow-lobed; petioles 0.3-1.0 (1.8) cm long; capitulescence of several heads tightly clustered on short peduncles; heads radiate, 3-4 mm high, 4-5 mm wide, involucre short-campanulate; ray flowers ca. 8-12, ligules white, 2-5 mm long, oblong; disc corollas yellow, often purple-tinged, 1.5-2.0 mm long, throats narrowly campanulate-funnelform; achenes 1.5-1.8 mm long, narrowly obovate to oblong-ovate, with callous margins, the margins and faces short-pubescent; pappus of a prominent crown of squamellae and 2 (rarely 1) unequal, delicate bristles, the longest 0.5-1.0 mm long; chromosome number, unknown.

Sierra Madre Occidental of Chihuahua and Sonora. Flowering Aug-Nov, and probably in the spring also. (Fig. 3).

REPRESENTATIVE SPECIMENS:

Mexico: CHIHUAHUA. *Damon* s.n. (UC); Guicorichi, Rio Mayo,

Gentry 1973 (ARIZ, UC, US); near Batopilas, *Goldman* 215 (GH, NY, US); Madrono Mine, ca. 5 km NW of Pinos Altos, *Hewitt* 171 (GH); Guayanopa Canyon, Sierra Madre, *Jones* s.n. (POM, US); Santa Clara Mts., *LeSueur* 340 (ARIZ, CAS, GH, LL, TEX, UC); Mapula Mts., *Pringle* 764 (LL, NY, RSA, UC, US). SONORA. La Mesa Colorado, *Gentry* 541, 541m (ARIZ, DS); Sierra de Papas, *Gentry* 630 (DS).

Everly (1947) treated *Perityle microcephala* as a synonym of *P. spilanthoides*. I have found, however, that *P. microcephala* represents a valid species, while *P. spilanthoides* is synonymous with the weedy variety of *P. microglossa*.

Perityle microcephala belongs with the group of white-rayed species which includes *P. turneri*, *P. lineariloba*, and *P. microglossa*. All of these taxa are quite similar in achene, pappus, and most other floral characters, but *P. microcephala* is clearly delimited from *P. turneri* and *P. lineariloba* by its capitulescence of small, tightly clustered heads, grayish pubescence, and is easily separated from *P. microglossa* by its pubescence and perennial habit. Overall morphological similarity and distributional considerations (Fig. 3) suggest that *P. microcephala* is most closely related to *P. microglossa*. *Pringle* 764 and *Gentry* 630, here ascribed to *P. microcephala*, approach *P. microglossa* in vegetative characteristics.

9. *Perityle microglossa* Benth. Bot. Sulph. 119. 1844. TYPE: Nicaragua (?): Realejo, Nicaragua (?), 1837, *R. B. Hinds* (K!).

9a. *Perityle microglossa* var. *microglossa*

Perityle acmella Harv. & Gray, Mem. Amer. Acad. II. 4: 77. 1849. TYPE: Mexico: "California", *Coulter* 278 (Holotype, GH!; isotypes, NY!).

Galinsogeopsis spilanthoides Schultz-Bip. in Seem. Bot. Herald 307. 1856. TYPE: Mexico: SINALOA: Sierra Madre, 1849, *B. Seeman* 1982 (Lectotype, K!). LECTOPARATYPE: same data, *B. Seeman* 1981 (K).

Pericome spilanthoides Benth. & Hook. ex. Hemsl. Biol. Centr. Amer. Bot. 2: 215. 1881.

Perityle microglossa var. *effusa* A. Gray, Syn. Fl. N.

Amer. 1: 332. 1884. TYPE: Arizona: Santa Catalina Mts., 5 June 1882, C. G. Pringle (Holotype, GH!; fragment, US!; isotype NY!).

Perityle effusa Rose, Contr. U.S. Nat. Herb. 1: 104. 1891. TYPE: Mexico: SONORA: Alamos, 26 Mar.-8 Apr. 1890, E. Palmer 350 (Lectotype, US!; isolectotypes GH!, NY!). LECTOPARATYPE: same data, E. Palmer 377 (US!); isolectoparatypes, (GH, NY!).

Perityle spilanthoides (Schultz-Bip.) Rydb. N. Amer. Fl. 34: 17. 1914.

Plants weedy, herbaceous annuals, 20-60 cm high, erect or decumbent, mostly branching above the base, stems few or many, upper portions, especially peduncles, copiously glandular-puberulent, rarely merely puberulent with few glandular hairs; leaves opposite or alternate, mostly opposite, puberulent, glandular-puberulent or glabrous, often turning purplish, (2.0) 3.0-7.0 (10.0) cm long, (1.5) 2.0-5.0 (9.0) cm wide, extremely variable in size and shape, cordate, ovate, broadly ovate-cordate to subreniform, or subdeltoid, the margins merely singly or doubly crenate-even or irregular, to strongly 3-lobed or cleft, pedately divided, or subhastate; petioles 0.5-3.0 (4.0) cm long; capitulescence of 1-3 or many heads clustered on relatively short peduncles 0.6-3.5 (6.0) cm long; heads radiate, 3.5-4.5 (6.0) mm high, 4.0-6.5 (7.0) mm wide, involucre campanulate; ray flowers 6-12, ligules white, 1.5-3.5 mm long, oblong; disc corollas yellow, 1.2-2.2 mm long, throats tubular-funnelform; achenes 1.5-2.0 mm long, linear-oblong to linear-elliptic, rarely very narrow and short obovate, with thin to prominent callous margins, the margins ciliate, the faces glabrous or puberulent; pappus of a crown of squamellae and 2 unequal bristles, the longest 0.8-1.2 mm long; chromosome numbers, $n = 34, 51$.

Rather widespread weed of northwestern Mexico, most common in Sonora, Sinaloa, and Baja California Sur, ranging south to Colima, seemingly introduced in northeastern Mexico and extreme south Texas. Flowering probably year around. (Fig. 3).

REPRESENTATIVE SPECIMENS:

MEXICO: Baja California Sur. San Jose del Cabo, *Anthony* 326 (CAS, DS, GH, POM, UC, US); ca. 6 km NW of Mira Flores, *Carter* 2663 (DS, UC, US); Arroyo de los Pozos, *Moran* 6886 (SD); La Paz, *Palmer* 92 (CAS, GH, NY, US); Boca de la Sierra, *Powell and Sikes* 1672 (SRSC, TEX); 1 mi N of Pescadero, *Powell and Sikes* 1676 (SRSC, TEX); vicinity of San Jose del Cabo, *Wiggins* 5689 (DS, NY, UC, US). **Chihuahua.** Tres Hermanos, SW of Batopilas, *Hewitt* 36 (GH). **Colima.** Colima, *Orcutt* 4551 (DS). **Nayarit.** Acaponeta, *Jones* s.n. (POM, UC); San Blas, *Maltby* 22 (US); Maria Magdalena Islands, *Maltby* 175 (NY, US); Tepic, *Palmer* s.n. (US). **San Luis Potosi.** near waterfall at El Salto, *King* 3877 (NY, TEX, UC, US); from San Luis Potosi to Tampico, *Palmer* 1093 (GH, NY, US). **Sinaloa.** Culiacan, *Brandeggee* s.n. (UC); ca. 64 mi S of Culiacan, *Breedlove* 1545 (DS); Imala, *Gentry* 5455 (ARIZ, DS, NY, UC); San Blas, *Jones*, s.n. (CAS, NY, POM, UC); Lodiago, *Palmer* 1614 (GH, NY); 56 mi NW of Mazatlan, *Powell and Sikes* 1682 (SRSC, TEX); Rio del Fuerte, near El Fuerte, *Rose, Standley and Russell* 13587 (NY, US); vicinity of Villa Union, *Rose, Standley and Russell* 13932 (NY, US); ca. 5 mi E of Costa Rica, *Sikes and Babcock* 192 (SRSC, TEX); 70 mi S of Mazatlan, *Sikes and Babcock* 206 (SRSC, TEX). **Sonora.** 15 mi NE of Alamitos, Rio San Miguel, *Abrams* 13357 (DS); Hermosillo, *Brandeggee* s.n. (DS, GH); 12 mi W of Navojoa, *Gentry* 7950 (UC, US); Alamos, *Palmer* 673 (US); Rio Mayo, Navojoa, *Sikes and Babcock* 177 (SRSC, TEX); 2.4 mi N of Soyopa, *Sikes and Babcock* 157 (SRSC, TEX); 23 mi E of Navojoa, *Sikes and Babcock* 185 (SRSC, TEX). **Zacatecas.** near San Juan Capistrano, *Rose* 2427 (NY, US). **U.S.A.: TEXAS:** Cameron Co. Rio Hondo, *Chandler* 7007 (US); E of Rio Hondo, *Clover* 1742 (ARIZ, TEX); Laguna Atacosa Refuge, *Fleetwood* 6069 (TEX). Willacy Co. Sauz Ranch, *Johnston* 53, 280 (TEX).

The type locality originally given for *Perityle microglossa*, Realejo, Nicaragua, is probably in error. The southern-most collection I have seen was from Colima, Mexico (Fig. 3), and it seems likely that the species would have been collected again in Nicaragua or in intermediate localities if it were there. The type locality probably was San Blas, Nayarit, which also was visited during the Voyage of the Sulphur and where *P. microglossa* is known to occur. According to Rogers McVaugh (personal communication), the localities of many other Sulphur collections were mixed up in similar fashion.

The variable nature of *Perityle microglossa* is evident

from the synonymy and from Everly's (1947) confused treatment of the taxon. The current studies have led to the recognition of two biological entities within *P. microglossa*. One is var. *microglossa* (Fig. 3), a widespread, weedy polyploid ($n = 34, 51$), and the other is var. *saxosa* (Fig. 3), a more restricted "native" diploid ($n = 17$). Greenhouse tests utilizing numerous collections of var. *microglossa* have shown that it is self-compatible and that it reproduces prolifically by seed. Only a few such tests have been conducted with var. *saxosa*, but all have indicated self-incompatibility for the diploid taxon. The morphological characters which distinguish the two varieties are not entirely consistent, and several morphological intermediates, for which chromosome numbers are not known, are found among existing collections. Variety *microglossa* typically exhibits shorter ligules, glandular-pubescent and shorter peduncles, tighter capitulescences, and a weedy habit, as compared to var. *saxosa* that usually displays longer ligules, rather smooth and longer peduncles, more lax capitulescences, and a "native" habit.

Morphologically, *Perityle microglossa* (particularly var. *saxosa*) is close to *P. microcephala*. Considering the evidence presented for these two species, it can be postulated that *P. microglossa* evolved from the mountain-dwelling *P. microcephala* through derivation of annual habit and adaptation to soil habitats. Variety *microglossa* must have evolved in response to polyploidization and development of reproductive self-compatibility which allowed for its "weedy" proliferation.

Additional studies of *Perityle microglossa* var. *saxosa*, as well as *P. microcephala*, are most desirable. If var. *saxosa* proves to be a "native," diploid, and self-incompatible progenitor of var. *microglossa*, then perhaps specific status should be accorded the latter taxon.

9b. ***Perityle microglossa* var. *saxosa*** (Brandeg.) Powell, comb. nov.

Perityle saxosa Brandeg. Zoe 5: 225. 1905. TYPE: Mexico: SINALOA: vicinity of Culiacan, Cerro Colorado, 5 Nov. 1904,

Brandeggee (Holotype, UC!; isotypes, GH!, POM!, US).

Perityle urticifolia Rydb. N. Amer. Fl. 34: 15. 1914.
TYPE: **Mexico:** SINALOA: Tepic, 5 Jan.-6 Feb. 1892, *E. Palmer* 1960 (Holotype, NY!; isotypes, GH!, UC!, US!).

Plants herbaceous annuals, possibly rarely weak perennials, 15-50 cm high, erect, upper stems and peduncles sparsely to densely puberulent, rarely moderately glandular-puberulent; leaves opposite or alternate, mostly opposite, glabrous to puberulent, rarely glandular-puberulent, 2-6 (8) cm long, (1.0) 1.5-3.5 (5.0) cm wide; capitulescence usually open, of 1-3 heads on relatively long peduncles, 2-7 cm long; ligules 3.5-4.5 mm long; disc corollas 1.7-2.0 mm long; achenes 1.0-1.6 mm long; pappus bristles 2, unequal, the longest 1.0-2.0 mm long; chromosome numbers $n = 17, 18$.

Mostly in foothills and lower elevations, both sides of the Sierra Madre Occidental, perhaps most common in Chihuahua, Sonora, and Sinaloa. Flowering probably year around. (Fig. 3).

REPRESENTATIVE SPECIMENS:

MEXICO: **Chihuahua.** Temores, *Flyr* 60 (TEX); near Descanso, *Flyr* 77 (TEX); *Palmer* 238 (GH, NY, US). **Durango.** Tamazula, *Gentry* 5234 (ARIZ, DS, GH, NY, UC). **Nayarit.** 4 mi E of Jalcocotan on road to Tepic, *McVaugh* 12147 (US). **Sinaloa.** 68 mi N of Mazatlan, *Flyr* 128 (TEX); 4 mi S of La Cruz junction, on MEX 15, *Flyr* 122 (TEX); Cerro Colorado, *Gentry* 5468 (ARIZ, DS, NY, UC, US); Canyon de Tarahumare, Sierra Surotato, *Gentry* 7315 (GH, NY, US); road from Las Flechas to La Rastra, *Goldman* 323 (GH, NY, US); 30.4 mi E of Villa Union, *Powell and Turner* 1853 (SRSC, TEX). **Sonora.** just S of Jecori, *Drouet, Richards, and Lockhart* 3692 (DS, GH, NY); 18 mi NW of Campas, *Drouet, Richards, and Lockhart* 3704 (DS, GH); San Bernardo, Rio Mayo, *Gentry* 1255 (ARIZ, GH, UC); near Alamos, *Gentry* 4825 (ARIZ, DS, GH, NY); 12 mi SE of Colonia Oaxaca, *Hastings and Turner* 65-43 (ARIZ, DS, SD); Petaquilla Canyon, *White* 3320 (ARIZ, GH); La Vega Azul, SW of Cononia Morelos, *White* 4852 (ARIZ, GH, NY, US); 35 mi NE of Cajeme, on road to Tesopaco, *Wiggins* 6408 (DS, US).

The Hastings and Turner and the White collections from NE Sonora are tentatively assigned to var. *saxosa*, but their

somewhat doubtful affinity with this taxon should be noted. The specimens have elongated achenes, approaching the fruit characteristics of *Perityle ciliata* and *P. coronopifolia*, and they are perennial. In vegetative features they are more like *P. microglossa*. Perhaps the unusual collections are from a relict population which is transitional between the shorter-achened (e.g., *P. microglossa*) and the longer-achened (e.g., *P. ciliata*) members of the white-rayed alliance. Again, however, as is the case with most of the poorly collected Sierra Madre taxa, further study is required.

10. ***Perityle canescens*** Everly, Contrib. Dudley Herb. 3: 393. 1949. TYPE: **Mexico**: SINALOA: Capadero, Sierra Tacuichamona, 12 Feb. 1940, *H. S. Gentry* 5588 (Holotype, DS!; isotypes ARIZ!, GH!, NY!, UC!, US!).

Plants low, suffruticose perennials, 6-15 cm high, densely leafed upper stems pilose; leaves opposite or alternate, pilose-hirsute to villous, 1.2-1.7 cm long, 0.5-0.9 cm wide, 3-pinnatifid with linear segments, ovate-cordate in outline, crisped; petioles 5-9 mm long; capitulescence essentially of solitary heads on short peduncles; heads radiate, 5-7 mm high, 6-8 mm wide, involucre broad campanulate; ray flowers ca. 10, ligules white, 2.5-3.5 mm long, oblong to broadly so; disc corollas yellow, becoming purple-tinged 2.5-3.0 mm long, throats broad tubular; achenes 2.0-3.5 mm long, oblong-ob lanceolate and nearly truncate on both ends, with thick callous margins, the margins merely puberulent, faces evenly puberulent; pappus of a prominent crown of united, erose squamellae, and 2 very unequal, rather stout, bristles, the longest 1.5-2.3 mm long; chromosome number, unknown.

Known only from the type collection.

Perityle canescens is related to *P. coronopifolia* from which it is distinguished by habit; dense indument; tendency for solitary heads; leaf morphology; thickly calloused achenes with short-pubescent margins; strong, more or less

united crown of pappus squamellae; stout pappus bristles; and distribution.

Two other species, *Perityle ciliata* and *P. hofmeisteria* are grouped with the above taxa in the white-rayed alliance, largely on the basis of their similar floral characteristics (particularly achene and pappus). In habit and achene shape, *P. canescens* resembles *P. lemmoni* (sect. *Laphamia*; Powell, 1973), but the former taxon obviously belongs with sect. *Perityle* on the basis of its pappus crown.

11. ***Perityle ciliata*** (L. H. Dewey) Rydb. N. Amer. Fl. 34: 17. 1914.

Laphamia ciliata L. H. Dewey, Bot. Gaz. 20: 425. 1895.
TYPE: **Arizona:** rocks along Pine Creek near Pine, Ariz., 26 Aug. 1891, D. T. MacDougal 676 (Holotype, US!; isotype, US!).

Plants suffruticose perennials, 15-30 cm high, many-stemmed, erect to pendulous, densely short-pubescent above; leaves opposite or alternate, densely gray-pubescent underneath, pubescent to puberulent on upper surfaces, 0.8-2.0 (3.0) cm long, 0.6-1.3 (2.4) cm wide, deltoid-ovate to ovate-rhombic, the margins serrate, shallow-lobed, or serrate-crenate; capitulescence of several heads clustered on short peduncles; heads radiate, 5-7 mm high, 5.5-7.0 mm wide, involucre campanulate; ray flowers ca. 6-10, ligules white, 3-6 mm long, broadly oblong to oblong-elliptic; disc corollas yellow, often purple tinged, 2.0-2.5 (3.0) mm long, throats tubular to tubular-funnelform; achenes 2.0-2.8 mm long, linear-oblong, with prominent callous margins, the margins long-ciliate, the faces slightly angled and pubescent; pappus of a crown of squamellae and 2 (rarely 3) slender bristles, 1.5-2.0 (2.5) mm long; chromosome number, $n = 17$.

Restricted in distribution to the mountains of central Arizona; rock-dwelling. Flowering spring, summer, and fall. (Fig. 3).

REPRESENTATIVE SPECIMENS:

Arizona: APACHE CO.: Springerville, *McGinnies* (ARIZ). COCONINO CO.: Long Valley, Coconino Natl. Forest, Coconino Rec. Crew 492

(US); Oak Creek, W of Troutdale, *Goodding* 198-47 (ARIZ, SMU); 4 mi W of Strawberry, *Sikes* 99 (SRSC, TEX). GILA CO.: Barnhart Pass, Matzatzal Mts., *Collom* 102 (GH, NY, US); Fossil Creek Hill, *Collom* 594 (US); Parker Creek Canyon, Sierra Ancha Mts., *Gould* 3632 (ARIZ, CAS, UC); Workman Creek Falls, Sierra Ancha, *Johnson* (ARIZ); Peterson Ranch, Sierra Ancha, *Pase* 1306 (ARIZ); 5.8 mi W of Strawberry, *Sikes and Patterson* 427 (SRSC, TEX). MOHAVE CO.: Hualapai Mts., *Braem* (DS); trail to Potato Patch, Hualapai Mts., *Braem* 875 (DS). YAVAPAI CO.: near Senator Mine, along road from Prescott, *Eastwood* 16721 (CAS); between Prescott and Ash Fork, *Eastwood* 16770 (CAS); Groom Creek, mts. near Prescott, *Kearney and Peebles* 9750 (ARIZ, UC); near Granite Dells, vicinity of Prescott, *Kearney and Peebles* 12780 (ARIZ, GH, NY, US); Prescott, *Peebles, Harrison, and Kearney* 2645 (ARIZ, US).

This species is clearly related to *P. coronopifolia* from which it is conveniently delimited by leaf shape.

12. **Perityle coronopifolia** A. Gray, Pl. Wright. 2: 82. 1853. TYPE: **New Mexico**: GRANT CO.: copper mines of Santa Rita del Cobre, Sept., 1851, *C. Wright* 1196 (Holotype, GH!; isotypes, NY!, US!).

Laphamia coronopifolia (A. Gray) Hemsl. Biol. Centr. Amer. Bot. 2: 210. 1881.

Laphamia scopulorum M. E. Jones, Contr. West. Bot. 12: 48. 1908. TYPE: **Mexico**: CHIHUAHUA: Colonia Juarez, 6000 ft., 12 Sept. 1903, *M. E. Jones* (Holotype, POM!; fragment, US!).

Plants low, suffruticose perennials, 6-36 cm high, erect or pendulous, many-stemmed, very leafy, grayish-pubescent; leaves opposite or alternate, puberulent to densely so, or nearly glabrous, 0.7-2.5 (3.5) cm long, 0.5-1.2 (2.0) cm wide, 3-palmate and lobed with slender-spathulate segments; pedately divided, or delicately 2,3-pinnatifid with linear-filiform segments; petioles 2-8 (12) mm long; capitulescence of several heads clustered on short peduncles; heads radiate, 5.0-6.5 mm high, 5-6 mm wide, involucre campanulate; ray flowers ca. 8-12, ligules white, 3-7 mm long, broadly oblong, oblong-elliptic, to subspathulate; disc corollas yellow, often purple tinged, 2.0-2.8 mm long, throats tubular, tubular-funnelform, or tubular-campanu-

late; achenes 1.8-2.5 mm long, linear-oblong to narrowly oblanceolate, with thin or prominent callous margins, the margins typically long-white ciliate, rarely short ciliate, the faces slightly angled and glabrous or pubescent; pappus of a crown of squamellae and 2 (rarely 3) slender bristles, 1.5-2.5 mm long; chromosome number, $n = 17$.

Rather widespread and common in southern New Mexico-Arizona, and rare in northern Chihuahua, Mexico; rock dwelling. Flowering spring, summer, and fall. (Fig. 3).

REPRESENTATIVE SPECIMENS:

MEXICO: Chihuahua. near Colonia Juarez, 6000 ft, Sierra Madres, Jones (POM, US).

U.S.A.: Arizona: COCHISE CO.: Miller Canyon, Hauchuca Mts., Barneby 5172 (CAS, NY); Ramsey Canyon, Huachuca Mts., Goodding 758 (GH, NY, RSA). GRAHAM CO.: Fry Canyon, Pinaleno Mts., Shreve 4365 (ARIZ); Graham Mt., Thronber and Shreve 7783 (ARIZ). GREENLEE CO.: Mts. back of Clifton, Greene (NY); San Francisco Mts., Greene (POM); 0.5 mi N of Metcalf, Maguire, Richards and Moeller 11822 (ARIZ, GH, NY, US). PIMA CO.: Spud Ranch, Rincon Mts., Blumer 3331 (ARIZ, DS, GH, UC); north slope Baboquivari Peak, Clark 12565 (GH); San Pedro Vista, Santa Catalina Mts., Parker 8096 (ARIZ, NY, RSA, US); below Goose-Head Rock, Mt. Lemmon, Sikes 95 (SRSC). SANTA CRUZ CO.: Flux Canyon, Patagonia Mts., Kearney and Peebles 10193 (ARIZ, US); Nogales to Ruby, Kearney and Peebles 14961 (ARIZ, GH, NY). New Mexico: DOÑA ANA CO.: W side, Organ Mts., Dunn 7274 (NMC, RSA); E peaks, Organ Mts., Powell 1393 (SRSC); Dripping Springs Canyon, Organ Mts., Sikes 108 (SRSC). OTERO CO.: Dry Canyon, Rehn and Viereck (US). SOCORRO CO.: Mogollon Creek, Mogollon Mts., Metcalf 323 (NMC, NY, UC, US); Gila Hot Springs, Mogollon Mts., Metcalf 828 (POM, UC, US).

Perityle coronopifolia is closely related to *P. ciliata*, from which it is best distinguished by leaf shape. The species also has affinity with *P. canescens*. Both *P. coronopifolia* and *P. canescens* have lobed leaves which are technically distinguishable, and they are further delimited by the long white-ciliate achene margins, clustered heads, pubescence, and distribution.

The principal distribution of *Perityle coronopifolia* is in southern Arizona and New Mexico. The one known Mexican collection, originally described as *Laphamia scopulorum*, is

considered to be a morphological variant. The *Jones* specimens from near Colonia Juarez are both of poor quality but show delicate pinnatifid leaves, short-pubescent achene margins, and inconspicuous pappus squamellae. These two fruit characteristics indeed approach those of Laphamian taxa (Powell, 1973), but the strong indication of its relationship with the Peritylean *P. coronopifolia* suggests its correct placement with the latter species.

13. **Perityle hofmeisteria** Rydb. N. Amer. Fl. 34: 18. 1914.
TYPE: **Mexico:** DURANGO: vicinity of Durango, Apr.-Nov., 1896, *E. Palmer* 28 (Holotype, NY!; isotypes, GH!, US!).

Plants suffrutescent to herbaceous perennials (possibly also annuals), 12-25 cm high, puberulent; leaves opposite or alternate, puberulent, 1.0-5.5 cm long, 0.2-2.0 cm wide, ovate to subspathulate and entire to shallow-lobed, or ovate-cordate and serrate to serrate-lobed; petioles 0.5-2.0 (3.0) cm long; capitulescence of 1-3 heads borne on relatively short peduncles, 1.5-2.8 cm long; heads radiate, 6-7 mm high, 4-6 mm wide, involucre turbinate-campanulate; ray flowers ca. 10-12, ligules white, 4-5 mm long, oblong; disc corollas yellow, 2.5-3.0 mm long, throats tubular-funnel-form; achenes 2.5-3.0 mm long, linear-oblong to narrowly obovate, with thin or thick callous margins, the margins prominently ciliate, the faces puberulent especially in the centers; pappus of a crown of squamellae and 2 subequal bristles, 2-3 mm long; chromosome number, $n = 16 \pm 1$.

Seemingly endemic in Durango, Mexico; probably rock-dwelling. Flowering spring-fall. (Fig. 3).

SPECIMEN EXAMINED:

Mexico: DURANGO: 3 mi N of Rodeo, *Flyr* 332 (TEX).

The *Flyr* 332 specimen, said by the collector to be "seemingly an annual," conforms to the types of *Perityle hofmeisteria* in floral but not in vegetative features. The main differences are in habit appearance and leaf shape. The species is poorly understood at present, but its affinity is with

P. ciliata and *P. coronopifolia* from which it is readily distinguished by leaf morphology and distribution (Fig. 3).

14. **Perityle jaliscana** A. Gray in S. Wats. Proc. Amer. Acad. 22: 431. 1887. TYPE: **Mexico**: JALISCO: Rio Blanco, ca. 10 mi NW of Guadalajara, 17-23 Sept. 1886, *E. Palmer* 554 (Holotype, GH!; isotypes, NY!, US(2)!).

Plants low, suffruticose perennials, 5-17 cm high, stems spreading, densely puberulent; leaves opposite or alternate, densely puberulent to nearly glabrous, 2.0-3.5 cm long, 0.8-1.8 (2.0) cm wide, deltoid, deltoid-rhombic, deltoid-ovate, or subhastate to subhalberd, usually 2-4 lobed proximally, rarely serrate-lobed; petioles 0.7-1.3 (1.7) cm long; capitulescence of 1-several heads clustered on short, slender peduncles; heads discoid, 5.0-6.5 mm high, 4-5 mm wide, involucre funnelform-campanulate; disc corollas cream-white and purple-tinged, 2.0-2.5 (3.0) mm long, throats tubular-campanulate; achenes 1.8-2.2 (2.8) mm long, oblong or nearly so, slightly tapering to the base, truncate, with prominent callous margins, rarely with 3-callous margins, angled on both faces, the margins and faces short-pubescent; pappus of a vestigial crown of squamellae, and 2 (3) slender bristles, 0.5-1.0 mm long, the bristles rarely flattened; chromosome number, $n = 17$.

Rock-dwelling endemic in Jalisco, Mexico. Flowering spring-fall. (Fig. 4).

SPECIMENS EXAMINED:

Mexico: JALISCO: ca. 40 km N of Guadalajara, road to San Cristobal de la Barranca, *McVaugh* 22114 (NY, SD); Sierra San Esteban, near Guadalajara, *Pringle* 2352 (GH, UC, US); Sierra de San Esteban, *Pringle* 15634 (ARIZ, CAS, LL, SMU, US); *Rose and Painter* 7476 (NY, US); 5 mi SW, by road, from San Cristobal de la Barranca, *Sikes and Babcock* 383 (SRSC, TEX).

Although relatively few collections of *Perityle jaliscana* are known, it is the best-collected of four closely related endemic species of Jalisco, Mexico. The others, *P. rosei*, *P. trichodonta*, and the recently described *P. feddema*, are known only from type collections.

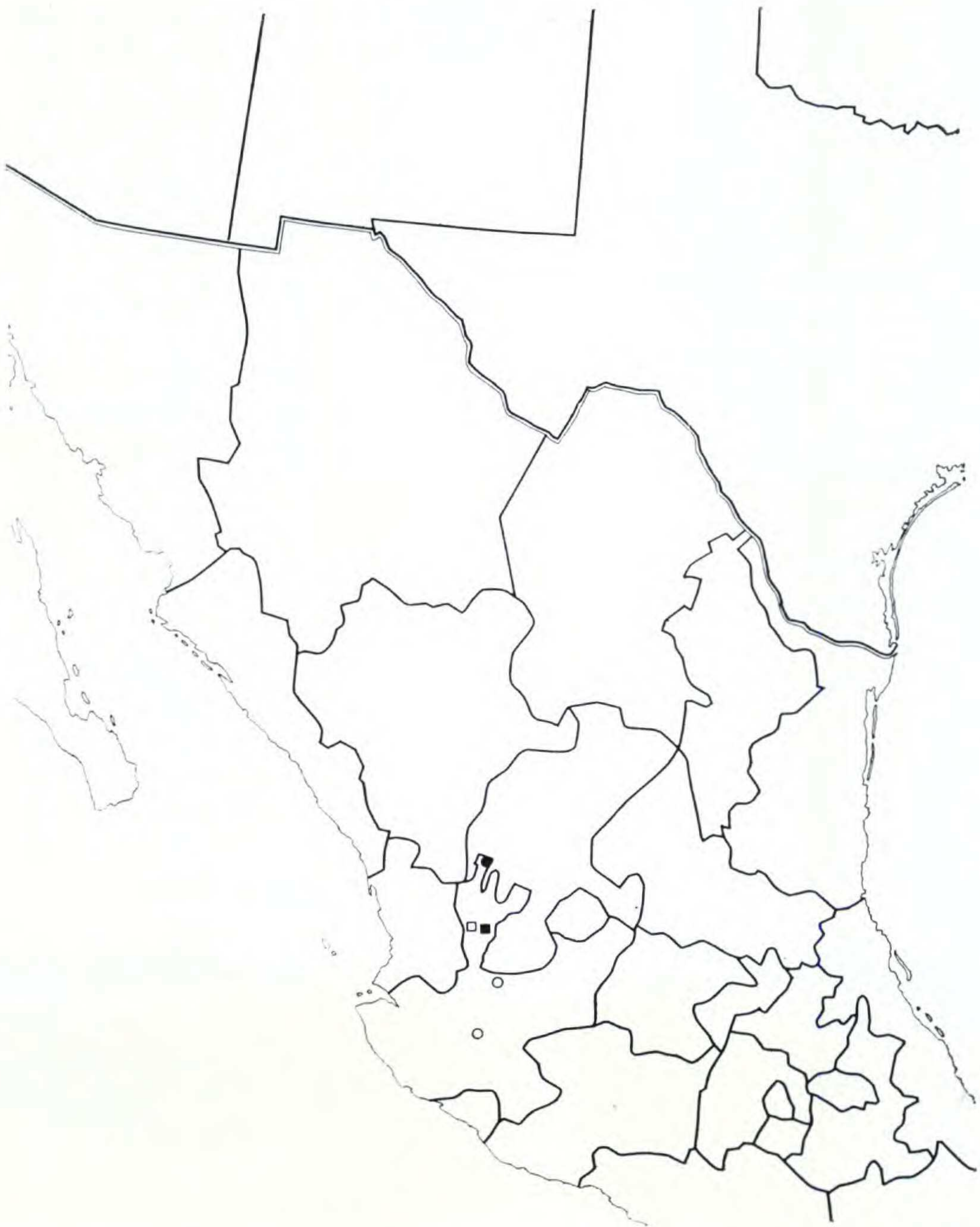


Fig. 4. Distribution of *P. jaliscana* (open circles); *P. rosei* (closed square); *P. trichodonta* (open square); *P. feddema* (closed circle).

Perityle jaliscana and *P. feddema* are the most distinct of the four species. I have followed Everly (1947) in recognizing *P. rosei* and *P. trichodonta*, even though future collections might indicate that they should be merged as a single species. Furthermore, both *P. rosei* and *P. trichodonta* might simply be ecological variants of *P. jaliscana*. I recognize the four species at this time mainly to preserve taxonomic consistency. In all three sections of the genus *Perityle* there are groups of closely related species that are no more distinctive than are the Jalisco endemics. In Jalisco, *P. feddema*, with its dissected leaves, seems to be quite distinct, and it was recently discovered in a locality not far from the other species (Fig. 4). Strict endemism is common among the rock-dwelling taxa of *Perityle*, and lacking evidence to the contrary, I think it possible that the taxa in question are endemic species.

Perityle jaliscana is most closely related to *P. rosei*. Most of its distinctive features, such as discoid heads, smaller, oblong achenes, shorter pappus bristles and squamellae, subhastate leaves, and short, dense pubescence, appear as if they could have been derived from *P. rosei*.

15. ***Perityle rosei*** Greenm. Proc. Amer. Acad. 40: 45. 1905. TYPE: **Mexico:** JALISCO: in the Sierra Madre W of Bolanos, 15-17 Sept. 1897, *J. N. Rose* 2947 (Holotype, US!; isotypes, GH!, NY!).

Plants suffruticose perennials, 10-20 cm high, stems erect or spreading, densely short-pilose; leaves opposite or alternate, short-pilose to puberulent, 1.8-3.0 cm long, 1.0-1.5 (2.0) cm wide, deltoid to deltoid-ovate or deltoid-rhombic, rarely subhastate, the margins entire or nearly so; petioles 5-9 mm long; capitulescence of 1-several heads on short peduncles; heads radiate, ca. 5 mm high, 4-5 mm wide, involucre campanulate; ray flowers ca. 13, ligules white, 2.0-2.5 mm long; disc corollas cream-white and purple-tinged, 2.0-2.3 mm long, throats tubular-campanulate; achenes 2.0-2.5 mm long, narrowly obdeltoid, with prominent callous margins, slightly angled on both faces, the

margins and faces puberulent to subglabrous; pappus of a short crown of squamellae, more or less united, and 2 (3-4) slender bristles, 1.5-2.0 mm long, the 3-4 bristles, if present, reduced in length; chromosome number, unknown.

Known only from the type collection. (Fig. 4).

Perityle rosei is best delimited from *P. jaliscana* by its radiate heads, nearly obconical achenes, longer crown of pappus squamellae and longer bristles, nearly deltoid, subentire leaves, and longer, less dense pubescence.

16. **Perityle trichodonta** Blake, Proc. Biol. Soc. Wash. 37: 60. 1924. TYPE: **Mexico**: JALISCO: Sierra Madre W of Bolanos, 15-17 Sept. 1897, *J. N. Rose* 2978 (Holotype, US!; isotype, GH!).

Plants low, suffruticose perennials, ca. 10 cm high, many-stemmed and spreading, densely gray-pubescent above; leaves mostly opposite, densely hirtellous-pilose and grayish, 7-9 mm long, 2.5-5.0 mm wide, ovate to ovate-rhombic and subhastate; petioles 2-4 mm long; capitulescence of 1-several heads clustered on short peduncles; heads radiate, ca. 4.5 mm high, ca. 4 mm wide, involucre funnelform-campanulate; ray flowers ca. 8, ligules white, 1.0-1.5 mm long; disc corollas cream-white and purple-tinged, 2.0-2.5 mm long, throats tubular-campanulate; achenes 1.5-2.2 mm long, narrowly obdeltoid, with prominent callous margins, slightly angled on both faces, the margins and faces puberulent to subglabrous; pappus of a short crown of squamellae, more or less united, and 2 slender bristles, 1.5-2.2 mm long, chromosome number, unknown.

Known only from the type collection. (Fig. 4).

Perityle trichodonta looks as though it could be a small-leaved, more densely pubescent, shorter liguled form of *P. rosei*, but it does differ in the characters listed. Future collections might reveal that *P. trichodonta* should be merged with *P. rosei*.

17. **Perityle feddema** McVaugh, Contr. Univ. Mich. Herb.

9: 431-433. 1972. TYPE: **Mexico:** JALISCO: Rancho Viejo, ca. 10 km ENE of Huejuquilla el Alto, rock-crevices, open oak-woodland, elev. 1900 m, 31 Oct. 1963, *Feddema* 2278 (Holotype, MICH; isotype, SRSC!).

Plants suffruticose perennials, 10-25 cm high, stems spreading, puberulent; leaves mostly opposite, puberulent, glandular-dotted, 1.7-3.5 cm long including petioles, dissected-pinnatifid with linear-spatulate segments; capitulescence of 1-3 heads on short, slender peduncles; heads discoid, 5-6 mm high, 3-5 mm wide, involucre funnelform-campanulate; disc corollas pale yellow, 2.3-2.8 mm long, throats tubular-campanulate; achenes 2-3 mm long, oblong-ob lanceolate, with prominent callous margins, angled on both surfaces, the margins and faces short-pubescent; pappus of a short crown of squamellae and 2 slender, unequal bristles, ca. 1.0 mm long; chromosome number, unknown.

Known only from the type collection. (Fig. 4).

This taxon possibly is most closely related to *Perityle jaliscana* that also has discoid heads, but its dissected leaves mark it as the most distinctive of the Jalisco endemics.

18. **Perityle parryi** Gray, Pl. Wright. 2: 106. 1853. TYPE: **Texas:** Canyon of the Rio Grande, Aug. 1852, *C. C. Parry* 521 (Isotype, NY!).

Laphamia parryi (Gray) Benth. & Hook. ex Hemsl. Biol. Centr. Amer. Bot. 2: 210. 1881.

Leptopharynx trisecta Rydb. N. Amer. Fl. 34: 23. 1914. TYPE: **Mexico:** CHIHUAHUA: dry cliffs, rocky hills near Chihuahua, 20 Mar. 1885, *C. G. Pringle* 183 (Holotype, NY!; isotypes, DS!, GH!, UC!, US!).

Plants low, woody-based perennials in crevices of rocks or tall, spreading, herbaceous to suffruticose perennials in soil, 10-75 cm high; leaves opposite or alternate, glandular-pubescent, 2-6 (9) cm long, 0.8-4.0 (6.0) cm wide, cordate to subreniform in outline, margins irregularly lobed, dentate, or laciniate, but typically shallow to deeply 3-lobed, and in some specimens even subcruciform; petioles 1.2-

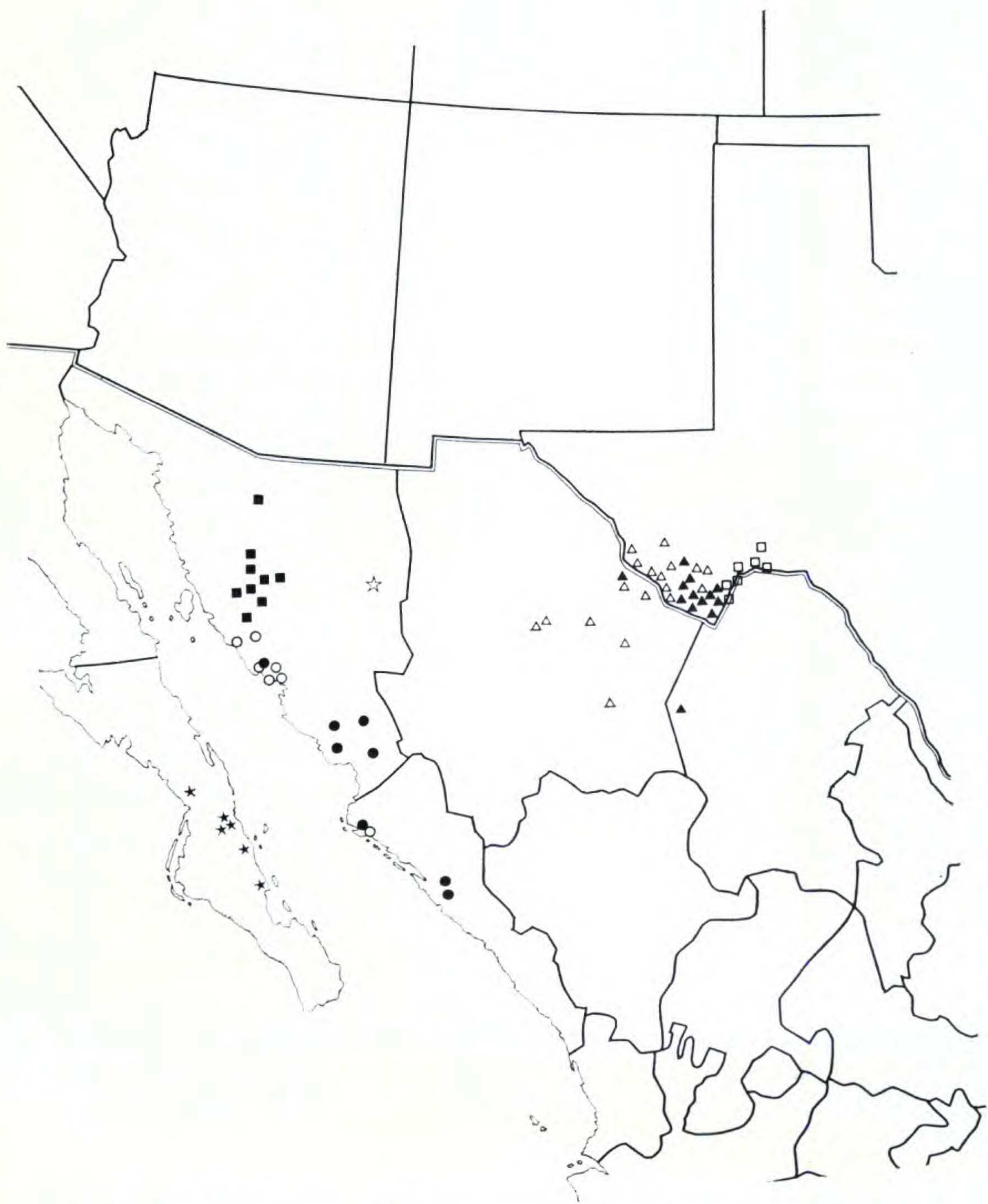


Fig. 5. Distribution of *P. parryi* (open triangles); *P. vaseyi* (closed triangles); *P. aglossa* (open squares); *P. cordifolia* (closed circles); *P. leptoglossa* (closed squares); *P. lloydii* (open star); *P. lobata* (closed stars); *P. palmeri* (open circles).

4.0 cm long; capitulescence of 1-3 heads borne on peduncles 1-7 cm long; heads radiate (rarely discoid), 0.8-1.0 cm high, 0.7-1.4 cm wide, involucre hemispherical to campanulate; bracts numerous, lanceolate to linear, rarely oblanceolate, acute to attenuate at the apex; ray flowers ca. 12-16 (rarely 1-6), ligules yellow, oblong, showy; disc flowers numerous, corollas yellow, (3.2) 4-6 mm long, throats tubular; achenes (2) 3-4 mm long, linear-elliptic to obconical-elliptic, with thin to prominent callous margins, the margins short-pubescent to dense-pilose, faces pubescent; pappus of a crown of squamellae, and 1 (rarely 0 or 2) barbellate bristle, (1.0-2.5) 3-6 mm long, typically tapering to a point, the barbs typically antrorse throughout, rarely becoming lateral or retrorse toward the tip; chromosome number, $n = 17$.

Western Big Bend area of Texas and adjacent Mexico; occurring in rocks and soils. Flowering essentially year around. (Fig. 5).

REPRESENTATIVE SPECIMENS:

MEXICO: **Chihuahua.** 11 mi NE of Camargo, *Johnston* 7920 (GH); road to San Carlos Mines, *Johnston and Muller* 39 (GH); 12 mi S of Ojinaga, *Johnston and Muller* 1443 (GH); near new lake on Rio Conchos, *Powell, Turner, and Magill* 2030 (SRSC, TEX); rocky hills near Chihuahua, *Pringle* 183 (DS, GH, NY, UC, US); 1 mi E of km 100, Ojinaga-Camargo road, *Sikes and Patterson* 397 (SRSC, TEX); 20 km N of Chihuahua, *Stewart and Johnston* 2119 (GH). U.S.A.: **Texas:** Brewster Co. Lost Mine Peak, Chisos Mts., *Correll and Johnston* 24540 (LL); Green Valley Ranch, *Correll and Wasshausen* 27825 (LL); Agua Fria Spring, *Cory* 18638 (GH); Santa Helena Canyon, *Cory* 26475 (US); N side Whirlwind Spring area, 02 Ranch, *Fletcher* 1143 (SRSC); Packsaddle Mt., *McAfee* 261 (SRSC); Chisos Mts., *Muller* 8247 (GH, NY, US, TEX); lower Window Trail, Big Bend Park, *Powell and Sikes* 1528 (SRSC, TEX); Basin, Chisos Mts., *Sikes* 32 (SRSC, TEX); Boot Springs Trail, *Sikes* 116 (SRSC, TEX); Nine-Point Mesa, *Warnock and Johnston* 17670 (SRSC); Rosillos Mts., *Warnock* 20603 (SRSC). Presidio Co. S edge of Presidio, *Correll and Johnston* 21867 (LL); 10 mi SE of Redford, *Correll and Johnston* 21898 (LL); Casa Piedra road, 20 mi S of Marfa, *Cox* s.n. (SRSC); Capote Creek, *Havard* s.n. (US); near Cottonwood Springs, Sierra Tierra Vieja, *Hinckley* 1850 (GH, NY, US); ca. 9 mi N of Lajitas, *Powell* 1243 (SRSC); 5 mi S of Redford, *Powell, Sikes, and Watson*

1396 (SRSC); 12 mi S of Redford, *Powell, Sikes, and Watson* 1398 (SRSC); 3 mi E of Ruidosa, *Powell and Brey* 1513 (SRSC); Capote Creek, ca. 1 mi below Capote Falls, *Powell* 1518 (SRSC).

The three yellow-flowered species of west Texas and adjacent Mexico (Fig. 5), *Perityle parryi*, *P. vaseyi*, and *P. aglossa*, are morphologically similar. *Perityle parryi* and *P. vaseyi* are particularly close and somewhat confusing taxonomically, primarily because of intermediate leaf forms and uncertain distributional integrity.

Perityle parryi occurs as a rock-dwelling subshrub and as a soil-dwelling perennial, typically with leaves that are merely 3-lobed. *Perityle vaseyi* is a soil-dwelling, taprooted perennial, with deeply trisected leaves. However, some Mexican populations of *P. parryi* (= *L. trisecta*) have deeply trisected leaves, as do some soil-dwelling Texas forms, and it is not always possible to distinguish the taxa by leaf morphology. *Perityle parryi* is further delimited by long-tapering pappus bristles (one per achene) which are antrorsely barbellate, bracts usually lanceolate or linear and somewhat attenuate, and disc corollas with usually narrowly tubular throats, as opposed to *P. vaseyi* with shorter pappus bristles that are retrorsely barbellate at the tips, bracts usually oblanceolate and acute, and more broadly tubular disc corollas.

It is suspected that the soil-dwelling forms of *Perityle parryi* and *P. vaseyi* may occasionally hybridize. Any hybridization, however, would be difficult to detect morphologically. It is not known whether the leaf variability of *P. parryi* is intrinsic or whether it might be the result of hybridization with *P. vaseyi*. In spite of marginal sympatry (Fig. 5), mixed populations of the two species have not been found, and no clear-cut hybrids have been detected. The subject is under experimental study.

The populations of *Perityle parryi* near Ruidosa, Texas, in the Sierra Vieja and one collection 12 mi S of Ojinaga (*Johnston and Muller* 1443) are notably anomalous. Their pappus bristles are short and have retrorsely barbed tips, resembling those of *P. vaseyi*. In addition, the Sierra Vieja

populations may be nearly rayless or entirely discoid. In other morphological characters the anomalous populations conform with *P. parryi*. The discoid forms should not be confused with *P. aglossa*, which is always rayless.

19. **Perityle vaseyi** Coult. Contr. U. S. Nat. Herb. 1: 42. 1890. TYPE: **Texas**: BREWSTER CO. Chisos Mts., 1889, G. C. Nealley (245?), (Holotype, US!).

Plants perennial with fleshy taproots, (10) 15-75 cm high, herbaceous to suffruticose, stems erect or spreading; leaves opposite or alternate, glandular-pubescent, 2.5-6.5 cm long, 2-5 cm wide, typically palmately divided into 3 lobes or subcruciform, with the lobes also dissected, cleft, or parted, rarely the leaves are strongly 3-lobed, cleft, or parted; petioles 1.4-3.5 cm long; capitulescence of 1-3 heads borne on peduncles 1-8 cm long; heads radiate, 0.8-1.0 cm high, 1.0-1.3 cm wide, involucre hemispherical to campanulate; bracts numerous, oblanceolate to linear-lanceolate, typically acute, less often alternate at the apex; ray flowers ca. 14-16, ligules yellow, oblong, showy; disc flowers numerous, corollas yellow, 3.2-5 (6) mm long, throats tubular to broadly so; achenes (2.0) 3.0-4.0 mm long, linear-elliptic to obconical-elliptic, with thin to prominent callous margins, the margins short-pubescent to dense pilose, faces pubescent; pappus of a crown of squamellae, and 1 (rarely 0 or 2) barbellate bristle, 1.5-4.0 mm long, typically truncate, the barbs retrorse or lateral toward the tip; chromosome number, $n = 17$.

Desert soils, especially gypsiferous clay, southwestern Big Bend area of Texas and adjacent Mexico. Flowering essentially year around. (Fig. 5).

REPRESENTATIVE SPECIMENS:

MEXICO: Chihuahua. 6.5 mi S of Ojinaga, *Powell, Turner, and Magill* 2002 (SRSC, TEX); 5 mi S of Ojinaga, *Powell, Turner, and Magill* 2079 (SRSC, TEX). **Coahuila.** Picachos Colorados, *Johnston and Muller* 141 (GH). **U.S.A.: Texas:** BREWSTER CO. petrified forest, *Cory* 2706 (GH); Hot Springs, *Cory* 6477 (POM); Glenn Springs, *Cory* 44014 (TEX); Terlingua Creek on 02 Ranch, *Fletcher* 917

(SRSC); 2-3 mi E of Terlingua, *Flyr* 16 (SMU, SRSC, TEX); 8 mi E of Lajitas, *Flyr* 19 (SMU, TEX); 1 mi SE of Terlingua, *Flyr* 180 (SMU, TEX); 2 mi SE of Hen Egg Mt., *Johnston and Warnock* 3656 (SRSC); top third of Packsaddle Mt., *McAfee* 184 (SRSC); 70 mi S of Alpine, *Powell and Sikes* 1530 (SRSC, TEX); 18 mi SE of Castolon, *Powell, Averett, and Watson* 1539 (SRSC, TEX); 0.4 mi N of Castolon, *Powell, Averett, and Watson* 1544 (SRSC, TEX); near Big Bend Tunnel, *Sikes* 39 (SRSC, TEX); near hwy. 118 entrance to Big Bend Park, *Sikes* 40 (SRSC, TEX); 7 mi E of Castolon, *Sikes and Averett* 330 (SRSC, TEX); road to Fisk Canyon, *Warnock* 1148 (SRSC); Avary Canyon, Big Bend Park, *Warnock* 9139 (SRSC); Big Bend Park, *Warnock and Wallmo* 12211 (SRSC); San Vicente, near the Rio Grande, *Young* s.n. (TEX).

As discussed previously under Phylogenetic Considerations, an ancestral connection is hypothesized for *Perityle vaseyi* and its allies with the *P. crassifolia* group of Baja California. The primary evidence for this possible relationship are the similar habits and pappus bristles (with retrorsely barbed tips) of *P. vaseyi* and *P. crassifolia* and the chromatographic profiles with yellow compounds, common to both groups.

Morphologically, *Perityle vaseyi* and its relatives are closer to the *P. cordifolia* group of western Mexico. The distribution of the Texas species (Fig. 5) could have been achieved by migration from a Sierra Madre Occidental origin. The headwaters of the Rio Conchos are in the Sierra Madre near Creel, just across the divide from *P. cordifolia* country. The distribution of *P. parryi* near the Rio Conchos in eastern Chihuahua and the location of *P. vaseyi* and *P. aglossa* near the Rio Grande, suggest the possibility of eastern migration along the river systems.

20. *Perityle aglossa* Gray, Pl. Wright 2: 107. 1853. TYPE: Texas: Rio Grande below Presidio del Norte, Aug. 1852, C. C. Parry (Lectotype, GH!).

Laphamia aglossa (Gray) Benth. & Hook. ex Hemsl. Biol. Centr. Amer. Bot. 2: 210. 1881.

Leptopharynx aglossa (Gray) Rydb. N. Amer. Fl. 34: 24. 1914.

Plants woody-stemmed perennials in rock crevices, 15-45

cm high; leaves opposite or alternate, glandular-pubescent, 2-4 cm long, 0.6-2.3 cm wide, ovate, subcordate or subdeltoïd, irregularly lobed, laciniate, or serrate-dentate, often shallow-3-lobed; petioles 0.8-2.3 cm long; capitulescence of 1-3 heads borne on peduncles 1.0-2.5 cm long; heads discoid, 8-11 mm high, 4-8 mm wide, involucre campanulate; bracts linear to linear-lanceolate, attenuated at the apex; disc flowers numerous, corollas yellow, typically pink- or purple-tinged, 4.2-6.0 mm long, throats tubular; achenes (2.0) 2.5-3.2 mm long, oblong-obconical, with prominent callous margins, the margins short-pubescent to dense-pilose, faces pubescent; pappus of a crown of squamellae and 1 (rarely 2) barbellate bristle, 3.7-5.5 mm long, tapering to a point, the barbs antrorse throughout; chromosome number, $n = 17$.

Restricted in southern Brewster Co. and Terrell Co., Texas, along and near the Rio Grande; crevices of limestone. Spring-fall. (Fig. 5).

REPRESENTATIVE SPECIMENS:

Texas: BREWSTER CO.: mouth of Regan Canyon on Rio Grande, *Hinckley and Warnock* 3737 (US, SRSC); near Boquillas, *Marsh* 306 (GH); near Big Bend Tunnel, *Sikes* 38 (SRSC); 4 mi W of Hot Springs, Big Bend Park, *Warnock and Turner* 8291 (SRSC); San Vicente Canyon, Big Bend Park, *Warnock and Parks* 8764 (LL, SMU, SRSC); limestone hills, Terlingua area, *Warnock* 13980 (SRSC); Heath Canyon, Black Gap Refuge, *Warnock* 20615 (SRSC); mouth of Regan Canyon, *Warnock and Hinckley* 461050 (SMU, SRSC, TEX). TERRELL CO.: mouth of San Francisco Canyon, *Surratt* 133 (SRSC); mouth of San Francisco Canyon, *Warnock and Surratt* 9817 (LL, SMU, SRSC); 9 mi E of Sanderson, *Warnock* 13155 (SRSC); along Rio Grande, between Regan Canyon and Sanderson Canyon, *Warnock* 15854 (SRSC).

Although only one type specimen is cited for *Perityle aglossa* (Parry, Aug. 1852), I have seen another specimen which probably came from Parry's original collection. At NY a sheet labeled "*P. aglossa*, Arroyo San Carlos, April 1852," displays specimens of both *P. aglossa* and *P. parryi*. Judging from present-day distributions of the species, I believe that the specimens were probably mixed after

Parry's collections were made. Furthermore, the *P. aglossa* specimen on the NY sheet probably was from the original collection and perhaps should be recognized as an isolectotype. The *P. parryi* specimen is discoid and probably came from the vicinity of Ruidosa above Presidio.

Perityle aglossa is a limestone-dwelling subshrub with good distributional integrity. In addition to habit and discoid heads, the species is distinguished from *P. parryi*, its closest relative, by subtle characters of the leaves, involucral bracts, and disc corollas.

21. **Perityle cordifolia** (Rydb.) Blake, Contr. U. S. Nat. Herb. 23: 1602. 1962.

Leptopharynx cordifolia Rydb. N. Amer. Fl. 34: 22. 1914. TYPE: **Mexico**: SINALOA: vicinity of Topolobampo, 23 Mar. 1910, J. N. Rose, P. C. Standley, and P. G. Russell 13294 (Holotype, NY!?!; fragment of type, UC!; isotype, GH!).

Plants suffrutescent perennials, rather low and spreading or semi-pendulent, 10-20 cm high, stems strong but herbaceous except at the bases, pilose; leaves mostly alternate, bright green, pilose, 3.5-11.0 cm long, 1.5-9.0 cm wide, cordate to broadly so, veins prominent, the margins doubly serrate-dentate, rarely crenate; petioles 1.5-4.5 mm long; capitulescence of solitary heads borne on rather stout peduncles, 2.5-6.0 cm long; heads radiate, rarely cernuous, 10-12 mm high, 9-15 mm wide, involucre hemispherical to campanulate, typically truncate at the base; bracts 10-13 mm long, linear and attenuate; ray flowers numerous, ligules yellow, 9-15 mm long, oblong-elliptic; disc flowers numerous, corollas yellow, 5-7 mm long, throats tubular; achenes 2.5-3.0 mm long, narrowly oblong, with thin or prominent callous margins, the margins typically densely ciliate, rarely puberulent, faces glabrous or puberulent in the center; pappus of a crown of squamellae, ca. 0.5 mm or less, and a single bristle, 4-7 mm long, the bristle tapering from base, a fine tip and densely barbellate; chromosome number, $n = 17$.

A petrophilic, cliff-dwelling species, possibly also rooted in soils of shaded bluffs, Sonora and Sinaloa, Mexico. Flowering probably year around. (Fig. 5).

REPRESENTATIVE SPECIMENS:

Mexico: SINALOA: hill near Topolobampo, *Flyr* 63 (TEX); N of Topolobampo, *Flyr* 76 (TEX); road to Los Animas beach from Los Mochis, *Flyr* 105 (TEX); 23 mi N of Culiacan, *Flyr* 111B (TEX); Cerro Tecomate, W of Pericos, *Gentry* 5743 (ARIZ, DS, GH, NY, UC); ca. 1 mi E of Topolobampo, *Sikes and Babcock* 188 (SRSC, TEX); bluffs W of Topolobampo, *Sikes and Babcock* 190 (SRSC, TEX). SONORA: 32 mi N of Navojoa, *Flyr* 103 (TEX); Canyon Sapopa, Rio Mayo, *Gentry* 1282 (ARIZ, GH, NY, UC); Aquibiquichi, near Batacosa, *Gentry* 3003 (ARIZ, CAS, GH, UC, US); Cerro de Bayajori, 12 mi W of Navojoa, *Gentry* 7949 (UC, US); 23 km E of Navojoa, *Moran* 4032 (DS, SD, UC); 1-2 mi N of San Carlos Resort, *Powell and Sikes* 1689 (SRSC, TEX); 10 mi N of Guaymas, *Randle and Werner* 1 (ARIZ).

Perityle cordifolia belongs with a group of four other morphologically similar species; *P. palmeri*, *P. leptoglossa*, and *P. lloydii* also of northwestern (mainland) Mexico, and *P. lobata* of Baja California. In spite of their similarities, the taxa are rather clearly delimited by vegetative features, excepting *P. lloydii*, which has characters of the other three mainland species. I have grown all of the taxa except *P. lloydii* under identical conditions, and each did maintain its characteristic morphology.

Everly (1947) treated *Perityle cordifolia* as synonymous with *P. palmeri*. I recognize these taxa as related but certainly distinct species. In fact, the soil-dwelling *P. palmeri* could have evolved from the rock-dwelling *P. cordifolia*, but on morphological grounds, *P. palmeri* shares even closer relationship with *P. lobata*. *Perityle cordifolia* is readily delimited from *P. palmeri* by its woody habit; bright green, pilose, cordate leaves with prominent veins and doubly serrate margins; long ligules; long attenuate involucre bracts; long pappus bristles; and long style branches.

22. ***Perityle leptoglossa*** Harv. & Gray in A. Gray, Mem. Amer. Acad. II. 4: 77. 1849. TYPE: **Mexico:** SONORA: "vicinity of Hermosillo," 1829-1830, *Coulter* 277 (Holotype, GH!; fragment, US!).

Leptopharynx leptoglossa (Harv. & Gray) Rydb. N. Amer. Fl. 34: 22. 1914.

Plants shrubby, spreading or erect, 10-60 cm high, stems densely grayish-puberulent; leaves mostly alternate, densely puberulent, gray-green, 3.0-5.5 cm long, 1.3-3.5 cm wide, cordate to cordate-ovate, the margins shallow-lobed and crenate to serrate, or merely crenate-serrate; petioles 1.3-2.5 cm long; capitulescence of solitary heads borne on relatively stout peduncles, 2-5 cm long; heads radiate, rarely cernuous, 8-10 mm high, 7-12 mm wide, involucre campanulate-cylindroidal and truncate at the base; bracts 5-8 mm long, linear to linear-lanceolate and attenuate to sub-attenuate; ray flowers numerous, ligules yellow, 6-10 mm long, oblong to oblong-elliptic; disc flowers numerous, corollas yellow, 4-5 mm long, throats tubular; achenes (2.2) 2.5-3.0 mm long, narrowly oblong, with thin or prominent callous margins, the margins long- or short-ciliate, the faces glabrous or minutely pubescent at the center; pappus of a crown of squamellae less than 0.5 mm long, and a single bristle, 2.5-4.5 mm long, the bristle tapering from base to apex and densely barbellate; chromosome number, $n = 17$.

Strictly rock-dwelling, in the vicinity of Hermosillo, Sonora, Mexico. Flowering probably year around. (Fig. 5).

REPRESENTATIVE SPECIMENS:

Mexico: SONORA: 3 mi S of Magdalena, *Aleramo* 13216 (DS); rocky sides of El Cerro de la Campana, *Drouet, Richards and Alvarado* 3387 (DS, GH, NY); 6 km N of Hermosillo, *Drouet and Richards* 3757 (DS); San Miguel de Horcasitas, *Eisen* (UC); 41 mi N of Hermosillo, *Flyr* 96 (TEX); 26 mi S of Hermosillo, *Gentry* 4572 (UC); ca. 28 mi N of Hermosillo, *Powell and Averett* 1520 (SRSC, TEX); ca. 28 mi N of Hermosillo, *Powell and Sikes* 1683 (SRSC, TEX); near Hermosillo, *Ripley* 14309 (CAS); vicinity of Hermosillo, *Rose, Standley, and Russell* 12346 (NY, US); near Magdalena, *Shreve* (NY); near Estacion Torres, *Shreve* 6070 (ARIZ); 8 mi W of Hermosillo, *Wiggins and Rollins* 96 (DS, GH, NY); ca. 1 mi N of Torres, *Wiggins* 6266 (DS, GH, POM, US); 12 mi from Ures on road to Babiacari, *Wiggins* 7359 (DS, TEX, US).

The most distinctive features of *Perityle leptoglossa* are:

shrubby habit; leaf margins shallow-lobed or merely crenate-serrate; densely puberulent upper stems and leaves; small heads and short ligules; short bracts; achene margins typically short-ciliate; pappus bristles typically slender at bases. At one locality ca. 28 mi N of Hermosillo, I observed a few plants that were 2½ ft. high, the largest woody plants in the genus. The species is related to *P. palmeri* and *P. lloydii*.

23. *Perityle lloydii* Rob. & Fern. Proc. Amer. Acad. 30: 118. 1894. TYPE: Mexico: SONORA. Badehuachi, 2 Dec. 1890, C. E. Lloyd 400 (Holotype, GH!; isotypes, NY!, UC!, US(3)!).

Leptopharynx lloydii (Rob. & Fern.) Rydb. N. Amer. Fl. 34: 22. 1914.

Plants semishrubby, erect, 10-40 cm high, stems woody to herbaceous, pilose; leaves mostly opposite, pilose, 2.5-4.5 cm long, 1.5-2.5 cm wide, cordate to cordate-ovate, the margins doubly serrate; petioles 1.5-3.0 cm long; capitulescence of solitary heads borne on peduncles 2.0-3.5 cm long; heads radiate, rarely cernuous, 8-9 mm high, 6-7 mm wide, involucre campanulate-cylindroidal and truncate at the base; bracts 5-7 mm long, linear and attenuate; ray flowers numerous, ligules yellow, 5-8 mm long, oblong to oblong-elliptic; disc flowers numerous, corollas yellow, ca. 4 mm long, throats tubular; achenes ca. 3 mm long, narrowly oblong, the callous margins short-pubescent; pappus of a minute crown of squamellae (ca. 0.2 mm long), and a single bristle ca. 3 mm long, the bristle slightly tapering from base to apex and densely barbellate; chromosome number unknown.

Known only from the type collection. (Fig. 5).

Perityle lloydii is poorly delimited from the other mainland taxa of the *P. cordifolia* species-group. In leaf shape, pubescence, and achene morphology (short-pubescent margins and reduced pappus squamellae) *P. lloydii* resembles *P. cordifolia*. In shrubby habit, small heads, short ligules, and other floral characters, the taxon approaches *P. lept-*

glossa. Its pubescence is like that of *P. palmeri*. Overall, *P. lloydii* possibly is closer to *P. leptoglossa*, and further collections might well provide evidence for merging the taxa.

24. **Perityle lobata** (Rydb.) I. M. Johnston, Proc. Calif. Acad. IV. 12: 1205. 1924.

Leptopharynx lobata Rydb. N. Amer. Fl. 34: 23. 1914.
TYPE: **Mexico**: BAJA CALIFORNIA: Comondú, 19 Feb. 1889, T. S. Brandegee (Holotype, GH!; isotype, UC!).

Plants fleshy-rooted perennials, possibly also annuals, low and spreading, semierect, or semipendulent, 10-40 cm high, stems weak, herbaceous, and rather brittle, usually purplish, glabrous to sparse-pilose; leaves mostly alternate, bright green, turning purplish, glabrous to sparse-pilose, 3-8 (12) cm long, 1.8-6.0 (8) cm wide, cordate, cordate-orbiculate, or subreniform, strongly 3-lobed, cleft, or parted, rarely divided, the segments further shallow-lobed or the blades even 5-cleft, the margins dentate-lobed and acuminate, overall the blades appear regularly laciniate; capitulescence of solitary heads borne on weak peduncles 3-8 (15) cm long; heads radiate, cernuous, 10-12 mm high, (5) 7-9 mm wide, involucre cylindroidal to campanulate, truncate at the base; bracts 5.0-9.5 mm long, linear-lanceolate to lanceolate-ovate, subattenuate, often purplish; ray flowers 8-12, ligules yellow, often turning purplish when dry, 2.5-9.0 mm long, oblong-elliptic; disc flowers numerous, corollas yellow, often purple-tinged, 3.8-5.0 mm long, throats tubular-funnelform; achenes (3) 3.5-5.0 mm long, narrowly oblong to oblong-elliptic, with prominent callous margins, the margins densely ciliate, faces glabrous to puberulent at the center; pappus of a crown of squamellae, 0.7-1.0 mm long, and a single bristle 3.5-6.0 mm long, the bristle very stout at the base, tapering to a point, densely barbellate; chromosome number, $n = 17$.

Restricted to Baja California Sur in the area of Sierra de la Giganta. Flowering year around. (Fig. 5).

REPRESENTATIVE SPECIMENS:

MEXICO: BAJA CALIFORNIA SUR. Arroyo Carrizal, E of Rancho El Horno, NE of San Javier, *Carter and Ferris* 3811 (UC, US); Arroyo Santo Domingo, Rancho El Horno, *Carter and Ferris* 3867 (DS, SD, UC); vicinity of Portezuelo E of La Victoria, *Carter and Ferris* 3911 (DS, UC); NW of Rancho El Horno, on steep escarpment of Mesa de San Alejo, W of San Javier, *Carter and Sharsmith* 4199 (UC); Purisima, *Gentry* 4213 (ARIZ, DS, GH, UC); Puerto Escondido, *Johnston* 4115 (CAS, GH, NY, UC, US); ca. 10 mi W of Loreto, *Powell and Sikes* 1663 (SRSC, TEX); ca. 10 mi S of Mission Dolores, *Wiggins, Carter, Ernst* 287 (DS, US); arroyo Quisapol, E of La Presa, trail to Laguna Caquihui, Sierra de la Giganta, *Wiggins* 15544 (DS).

Perityle lobata has perhaps been separated from mainland Mexico and its relatives there for about four million years. At least according to Moore and Buffington (1968), this is how long the Baja California peninsula has been drifting westward from the mainland. *Perityle lobata* is clearly related to *P. palmeri*. Distributional considerations suggest that the two present-day taxa once had a common range (Fig. 5), or else proximal distributions before the Sea of Cortez became a barrier of its present width.

It is possible that *Perityle lobata* has been introduced to the mainland and has hybridized there, accounting for some of the variability in mainland taxa such as *P. palmeri*. In fact, it might be postulated that *P. palmeri* has evolved from *P. lobata* instead of the other way around as previously assumed. However, if the latter conjecture were accurate, one might expect that *P. palmeri* would be more like *P. lobata* of Baja California. I have not found any evidence that *P. lobata* has been introduced recently to the mainland.

As opposed to *Perityle palmeri*, *P. lobata* can be recognized by its leaf architecture, its purplish stems, pubescence, ligule length and number, bract width, achene length, and its stout bristles.

25. *Perityle palmeri* S. Wats. Proc. Amer. Acad. 24: 57. 1889. TYPE: Mexico: SONORA: Guaymas, Oct., 1887, *E. Palmer* 308 (Holotype, GH!; isotypes, NY!, UC!, US (3)!).

Leptopharynx palmeri (S. Wats.) Rydb. N. Amer. Fl. 34: 23. 1914.

Plants fleshy-rooted perennials, low and spreading, semi-erect, or semipendulent, 10-25 cm high, stems herbaceous and rather brittle, often purplish, short or long pilose; leaves mostly alternate, short or long pilose, grayish-green, 6-10 cm long, 3.0-5.5 cm wide, cordate, cordate-ovate, to cordate-orbiculate, the margins acutely shallow-lobed and serrate-dentate, the lobes several, or the blades strongly 3-lobed, overall the blades may appear irregularly laciniate; capitulescence of solitary heads borne on peduncles 2-6 (8) cm long; heads radiate, often cernuous at maturity, 8-11 mm high, 6-13 mm wide, involucre hemispherical to campanulate and truncate at the base; bracts 7-10 mm long, linear to linear-lanceolate and attenuate; ray flowers numerous, ligules yellow, 7-8 (10) mm long, oblong-elliptic; disc flowers numerous, corollas yellow, 4-6 mm long, throats tubular; achenes 2.5-3.5 mm long, narrowly oblong, with prominent callous margins, the margins densely long-ciliate, faces glabrous or puberulent; pappus of a crown of squamellae, 0.5-0.9 mm long, and a single bristle, 3-5 mm long, the bristle stout, tapering from base to apex, and densely barbellate; chromosome number, $n = 17$.

Primarily, if not entirely, soil-dwelling, most common in the vicinity of Guaymas, Sonora, but also in northern Sinaloa, Mexico. Flowering probably year around. (Fig. 5).

REPRESENTATIVE SPECIMENS:

Mexico: SINALOA: Topolobampo, *Blakey* (ARIZ.) SONORA: Guaymas, *Brandeggee* (POM, UC); Plam Canyon, W side of Sierra Libre, 35 mi S of Hermosillo, *Carter* (ARIZ); San Pedro Bay, *Craig* 691 (POM); Guaymas, *Dawson* 1003 (DS, US); cliffs, E side of Guaymas, *Drouet and Richards* 3846 (DS); 2.8 mi N of Guaymas, *Lewis* 5334 (SMU); 36 mi S of Hermosillo, *Lindsay* 1125 (DS); near Guaymas, *Palmer* 1218 (US); Sahuaral Bay, *Powell and Averett* 1523 (SRSC, TEX); 1 mi E of San Carlos Resort, *Powell and Sikes* 1687 (SRSC, TEX); 6 km N of Empalme, *Ripley* 14307 (CAS); 1 mi E of San Carlos Resort, *Sikes and Babcock* 169 (SRSC, TEX); 1 mi N of Naval Base, Guaymas Bay, *Sikes and Babcock* 176 (SRSC, TEX).

Perityle palmeri is best distinguished from *P. lobata*, perhaps its closest relative, and from *P. cordifolia* by the following characters: fleshy roots, weak perennial habit in soils, lobing of the leaves, ligule length, bract length, and pilose pubescence.

26. **Perityle californica** Benth. Bot. Sulph. 23. 1844. TYPE: **Mexico**: BAJA CALIFORNIA: Magdalena Bay, 1837?, *R. B. Hinds* (K!).

Perityle plumigera Harv. & Gray, Mem. Amer. Acad. II. 4: 77. 1849. TYPE: **Mexico**: SONORA: "California" (vicinity of Hermosillo), *Coulter* 279 (Holotype, GH!; fragment, UC!, US!).

Perityle deltoidea S. Wats. Proc. Amer. Acad. 24: 57. 1889. TYPE: **Mexico**: BAJA CALIFORNIA: Los Angeles Bay, 1887, *E. Palmer* 568 (Holotype, GH!; isotypes, NY!, UC!, US!).

Plants delicate or robust annuals, 6-35 cm high, erect or decumbent, sparsely or densely leaved; leaves opposite or alternate, glandular-puberulent to short pilose, 1-6 (10) cm long, 0.5-2.5 (6.0) cm wide, often purplish when mature, deltoid, ovate, or cordate, 3-lobed to subcruciform with the segments serrate-crenate or shallow-lobed, or the margins merely shallow-lobed to serrate; petioles 0.3-1.5 (4.0) cm long; capitulescence of 1-5 heads borne on delicate peduncles; heads radiate, 3.5-7.5 mm high, 3.0-5.0 (7.5) mm wide, involucre narrowly to broadly campanulate; bracts linear, oblanceolate, or obovate; ray flowers 10-15, ligules yellow, oblong-elliptic; disc corollas yellow, 2.0-3.0 (3.5) mm long, throats tubular to subfunneliform; achenes 1.5-2.5 (3.0) mm long, narrowly obovate, oblanceolate, to oblong-oblanceolate, with thin or prominent callous margins, the margins short or long ciliate, faces puberulent to densely so; pappus of a crown of squamellae and a single bristle, 1.5-3.0 (3.5) mm long, the bristle barbellate to subplumose; chromosome numbers, $n = 13, 12, 11$.

Common in desert soils, Sonora and Sinaloa of mainland

Mexico, and along most of the Baja California peninsula to just S of La Paz. Flowering Dec.-June. (Fig. 6).

REPRESENTATIVE SPECIMENS:

MEXICO: BAJA CALIFORNIA. San Juan Mine, *Moran* 8117 (DS, SD, UC); Los Angeles Bay, *Palmer* 568 (GH, NY, UC, US); 4 mi S of Rancho Rosarito, *Powell and Turner* 1808 (SRSC, TEX); El Arco, N end of town, *Sikes and Babcock* 297 (SRSC, TEX); mesa S of Rancho Mesquital, *Wiggins* 11326 (DS, GH, UC). BAJA CALIFORNIA SUR. Isla Magdalena, *Brandeggee* s.n. (GH, UC, US); 20 km E of San Ignacio, *Carter, Alexander, and Kellogg* 1972 (DS, UC, US); 26 km NW of San Ignacio, *Carter, Alexander, and Kellogg* 2521 (DS, GH, UC, US); Arroyo del Cajon de Tecomaja, SW of Puerto Escondido, *Carter and Kellogg* 2906 (UC); Rancho El Horno, NE of San Javier, *Carter and Ferris* 3789 (UC); SE of La Soledad, *Carter* 5418 (UC); Arroyo, 4 mi above La Purisima, *Constance* 3146 (DS, GH, LL, US); Isla San Jose, *Moran* 3785 (DS, SD, UC); Isla Santa Catalina, *Moran* 3867 (DS, SD); Isla San Marcos, *Moran* 8983 (SD, US); Isla Carmen, *Moran* 9133 (SD); Isla Danzante, *Moran* 9253 (SD); Santa Rosalia, *Palmer* 185 (CAS, GH, US); ca. 19 mi N of La Paz, *Porter* 414 (CAS, DS, UC); 20 mi S of El Arco, *Powell and Sikes* 1650 (SRSC, TEX); 0.5 mi S of San Ignacio, *Powell and Sikes* 1653 (SRSC, TEX); ca. 8 mi S of Santa Rosalia, *Powell and Sikes* 1657 (SRSC, TEX); 33 mi S of Santa Rosalia, *Powell and Sikes* 1659 (SRSC, TEX); Bahia de la Concepcion, *Powell and Sikes* 1661 (SRSC, TEX); 10 mi W of Loreto, *Powell and Sikes* 1664 (SRSC, TEX); 13.6 mi S of Mulege, *Powell and Turner* 1835 (SRSC, TEX); 11.5 mi W of Loreto, *Powell and Turner* 1837 (SRSC, TEX); 15 mi W of San Javier, *Powell and Turner* 1845 (SRSC, TEX); 3 mi E of La Paz, *Sikes and Babcock* 216 (SRSC, TEX); near km 40 on hwy between La Paz and Santo Domingo, *Thomas* 8455 (CAS); Isla Partida, *Wiggins, Carter, and Ernst* 412 (DS); Comondú, *Wiggins* 5502 (CAS, DS, GH, NY, UC, US); 22 mi N of San Ignacio, *Wiggins* 7888 (DS, GH, TEX, UC, US); 20 mi S of Mulege, *Wiggins* 11408 (CAS, DS, GH, UC, US); 6 mi W of Canipole, *Wiggins* 11439 (CAS, DS, GH, UC, US); Llano Caquihui, W of Los Dolores, *Wiggins* 15516 (DS, US); 16 mi E of La Paz, *Wiggins* 15625 (DS, US); Isla Carmen, *Wiggins* 17497 (DS). SINALOA. N of Topolobampo, *Flyr* 72 (TEX); vicinity of San Blas, *Rose, Standley, and Russell* 13244 (NY, US); vicinity of Fuerte, *Rose, Standley and Russell* 13472 (NY, US); W side of Topolobampo Harbor, *Sikes and Babcock* 189 (SRSC, TEX). SONORA. 8 mi N of Hermosillo, *Breedlove* 1758 (DS); San Pedro Bay, *Craig* 662 (POM); E side of Guaymas, *Drouet and Richards* 3844 (CAS, DS, GH, US); 73 mi S of Hermosillo, *Flyr* 98A (TEX); 47 mi N of Hermosillo, *Frye and Frye* 2305 (GH, US); 1 mi E of San Carlos Resort, *Powell and Sikes* 1686 (SRSC, TEX); 1-2 mi

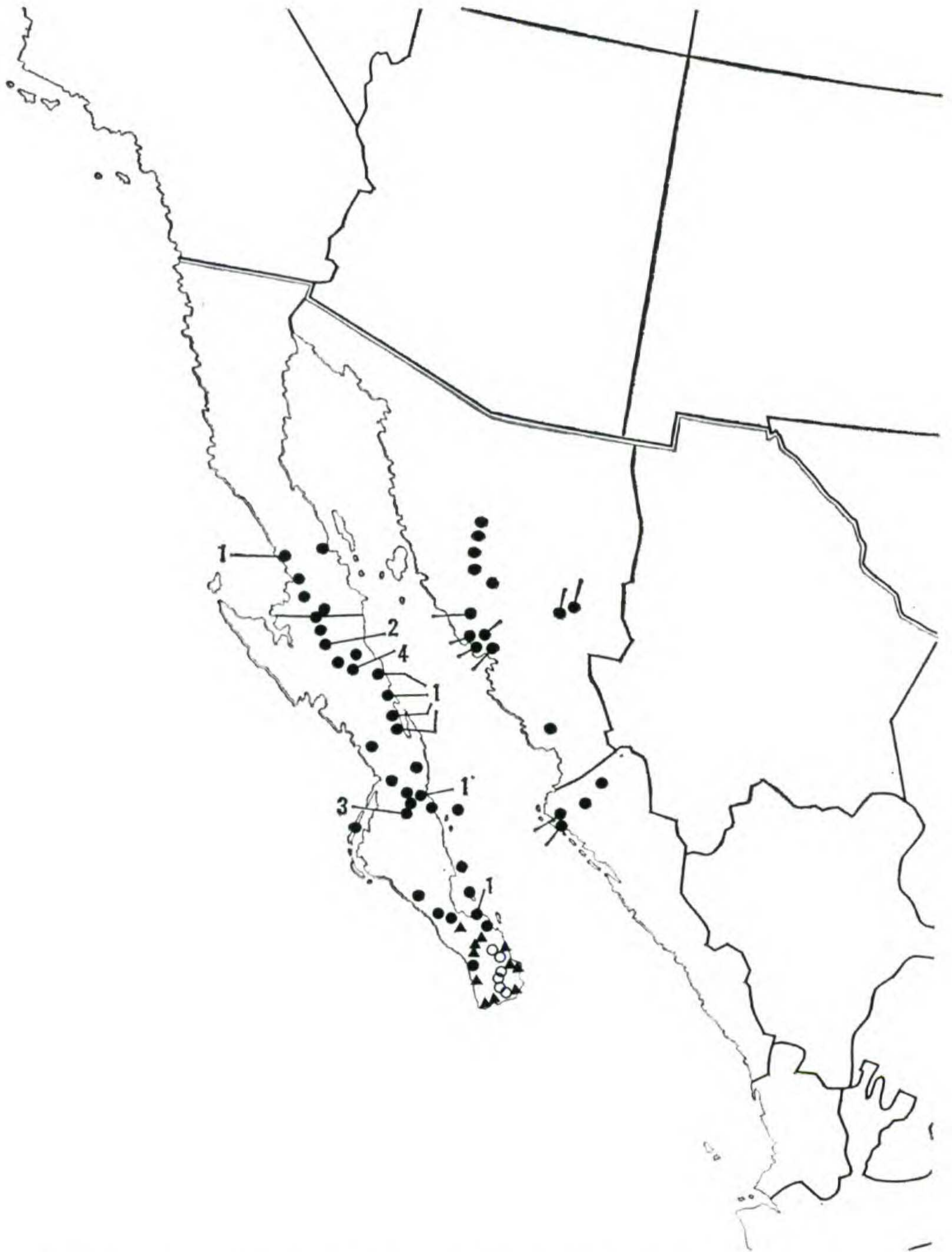


Fig. 6. Distribution of *P. californica* (closed circles); the bars indicate populations from which chromosome numbers were taken, with (1) $n = 11$ II, (2) $n = 12$ II, (3) $n = 13$ II, and (4) $n = 10$ II + 1 III; all mainland counts have been $n = 13$. *P. cuneata* var. *cuneata* (open circles); *P. cuneata* var. *marginata* (closed triangles).

N of San Carlos Resort, *Powell and Sikes* 1691 (SRSC, TEX); vicinity of Navojoa, *Rose, Standley, and Russell* 13140 (NY, US); 110 mi E of Hermosillo, *Sikes and Babcock* 151 (SRSC, TEX); 32 mi N of Hermosillo, *Shreve* 10053 (LL); 10 mi N of Hermosillo, *Wiggins* 6250 (DS, POM, US); 5 mi SE of Torres, *Wiggins* 6273 (DS, GH, POM, US).

In her discussion of *P. californica*, *Everly* (1947) emphasized the variable habit of this taxon. The species occurs in Baja California and in Sinaloa-Sonora of mainland Mexico. Most of its morphological variability is expressed in plant size, number of leaves, and leaf shape. Floral characteristics are essentially the same throughout the distributional range.

Chromosomal variability also exists in *Perityle californica* where numbers of $n = 13$, 12, 11, and 10 II + 1 III have been reported (Powell, 1968; 1972b). Some distributional and morphological correlation with chromosome number has been observed, although no taxonomic status is warranted for the cytotypes. Plants of the mainland populations are $n = 13$, as so far determined, and tend to be rather tall and robust with deeply lobed (often trilobed) leaves. In wet years *P. californica* is a common weed in some parts of Sonora and Sinaloa. Chromosome numbers of $n = 13$, 12, 11, and 10 II + 1 III have been found in Baja California populations (Fig. 6), and the plants are usually small with leaves not deeply lobed (mostly serrately-lobed). I have found the Baja California populations to be invariably small and scattered, but I have not seen the peninsula in a wet year. Populations with $n = 11$ are most common in Baja California and probably extend throughout the range of the species (Fig. 6). One population with $n = 12$ has been found, and those with $n = 10$ II + III presumably arose through hybridization of cytotypes with $n = 12$ and $n = 11$ (Fig. 6). The one peninsula collection with $n = 13$ (Fig. 6) could have been introduced from the mainland, or seemingly less likely at present, could represent the presence of native $n = 13$'s on the peninsula. It seems reasonable to conclude that *P. californica* in Baja California evolved by aneuploid reduction in chromosome number from mainland cytotypes.

Perityle californica does not share close or obvious relationship with any species, and its origin as a low-numbered aneuploid is not clear. The species is superficially similar to *P. cuneata* ($n = 16, 12$), but these taxa differ considerably in floral characters, particularly of the achenes and pappus. Indeed, the floral differences between these two aneuploid species are significant enough to cast considerable doubt upon their common origin. *Perityle californica* has narrow oblanceolate achenes with a single, long, subplumose pappus bristle, while *P. cuneata* has broad, obcordate or obovate achenes with two delicate pappus bristles. The morphology of *P. californica* (including flower color and achene and pappus features) resembles that of the *P. cordifolia* group ($x = 17$), and possibly originated therefrom by aneuploid reduction.

Certain aspects of the *Perityle californica* synonymy are somewhat confusing, but a good explanation of the historical situations was given by Everly (1947).

27. *Perityle cuneata* Brandeg. Zoe 1: 54. 1890. TYPE: **Mexico:** BAJA CALIFORNIA: Sierra de Laguna, near Todos Santos, 21 Jan. 1890, *T. S. Brandege* (Holotype, UC!; isotype, US!).

27a. *Perityle cuneata* var. *cuneata*.

Plants robust annuals, 25-50 (80) cm high, erect or decumbent, sparsely to densely leaved; leaves opposite or alternate, glandular-puberulent to nearly glabrous, 3-8 (15) cm long, 1.5-4.5 (11.0) cm wide, often purplish when mature, cordate to broadly so, ovate, or subhastate, the margins serrate-lobed to serrate-crenate; petioles 0.6-2.0 (5.0) cm long; capitulescence of 1-3 heads borne on rather stout peduncles; heads radiate, 5-8 (10) mm high, 6-10 (12) mm wide, involucre campanulate to hemispherical; bracts oblanceolate to obovate and attenuate; ray flowers 10-15, ligules yellow, oblong-elliptic; disc corollas yellow, 3.0-3.5 mm long, throats tubular; achenes (2.5) 3.0-3.8 mm long, obcordate-cuneate to oblanceolate, with broad callous mar-

gins, often purplish, the margins puberulent, faces glabrous to puberulent; pappus of a crown of squamellae and 2 (rarely 0-2) delicate bristles, 0.5-1.2 (2.0) mm long; chromosome number, $n = 12$.

Infrequent in soils, Cape Region of Baja California Sur to just S of La Paz, most common on eastern side. Flowering Jan.-Sept. (Fig. 6).

REPRESENTATIVE SPECIMENS:

Mexico: BAJA CALIFORNIA SUR: San Jose del Cabo, *Brandege* (DS, GH, US); Sierra San Francisquito and La Chuparosa, E side of Sierra de la Victoria, *Carter and Ferris* 3386 (DS, SD, UC); ca. 3 km above Boca de la Sierra, *Moran* 7091 (CAS, DS, GH, SD, TEX); Potrero de Almenta, S fork of Canyon San Pedro, *Moran* 7387 (CAS, DS, SD); ca. 5 mi S of San Antonio, *Powell and Sikes* 1667 (SRSC, TEX); Boca de la Sierra, *Powell and Sikes* 1671 (SRSC, TEX); 2 mi S of San Antonio, *Sikes and Babcock* 233 (SRSC, TEX); ca. 2 mi N of San Antonio, *Sikes and Babcock* 265 (SRSC, TEX); ca. 6 mi SW from Santiago, *Thomas* 7715 (CAS, DS, SD, US); ca. 5 mi SW of La Palma and ca. 8 mi NW from Santa Anita, *Thomas* 7738 (DS, SD, UC).

The two varieties of *Perityle cuneata* are morphologically similar, although extreme forms of these taxa do exhibit considerable differences. *Everly* (1947) recognized *P. cuneata* and *P. cuneata* var. *marginata* as conspecific. In addition to the morphological differences, I have recognized var. *cuneata* ($n = 12$) and var. *marginata* ($n = 16$) because of their chromosome numbers. Indeed, the chromosomal differences suggest that further study might demand the elevation of var. *marginata* to specific rank.

Besides its chromosome number, *Perityle cuneata* var. *cuneata* is characterized by robust habit, large cordate leaves, large heads, tubular disc corollas, obcordate-cuneate achenes, and attenuate involucre bracts. The plants of var. *marginata* are usually smaller with smaller leaves, smaller heads and other floral characters, campanulate-funnelform disc corollas, obovate achenes, and acute involucre bracts. In addition, var. *cuneata* usually occurs in higher hills and canyons of the Cape Region while var. *marginata* occurs mostly in sandy places not far above sea level.

Perityle cuneata does not exhibit a close morphological relationship with any other species. Superficially, *P. cuneata* most resembles *P. californica*, but it possibly evolved independently of the latter taxon by aneuploid reduction from the *P. cordifolia* line.

27b. ***Perityle cuneata* var. *marginata*** (Rydb.) I. M. Johnston, Proc. Calif. Acad. IV. 12: 1204. 1924.

Perityle marginata Rydb. N. Amer. Fl. 34: 14. 1914.
TYPE: **Mexico:** BAJA CALIFORNIA: San Jose del Cabo, 25 Mar. 1911, *J. N. Rose* 16459 (Holotype, NY!; fragment, UC!; isotypes, GH!, US!).

Plants delicate or robust annuals, 6-40 cm high, erect or decumbent; leaves 1.5-5.0 (10) cm long, 0.9-3.0 (5.0) cm wide, cordate, ovate, or deltoid, the margins doubly serrate-crenate to shallow-lobed; petioles 0.2-1.8 (4.0) cm long; heads radiate, 4-7 mm high, 4-7 mm wide; bracts subovate, oblanceolate, or linear-lanceolate and acute; ligules yellow; disc corollas yellow, 2 (2.5) mm long, throats narrowly campanulate, campanulate-funnelform, rarely subtubular; achenes 1.5-2.0 (2.5) mm long, obovate, subcuneate, rarely almost oblong, with prominent callous margins, the margins short or long-ciliate; pappus of a crown of squamellae and 2 (rarely none) delicate bristles, 0.5-1.0 (1.5) mm long; chromosome number, $n = 16$.

Infrequent in desert soils, Cape Region of Baja California Sur and N to near La Paz, most common on southern and western sides. Flowering probably year around. (Fig. 6).

REPRESENTATIVE SPECIMENS:

Mexico: BAJA CALIFORNIA SUR. San Jose del Cabo, *Jones* s.n. (NY, POM, SD, UC); Arroyo de los Pozos, *Moran* 6886 (CAS, DS, GH, TEX); 2.5 km NE of Cabo San Lucas, *Moran* 7049 (CAS, DS, GH, SD); 6.4 mi N of Todos Santos, *Porter* 79 (CAS, DS, UC); 1.4 mi W of El Coyote, *Porter* 118 (CAS, DS, UC); ca. 17 mi S of San Antonio, *Powell and Sikes* 1668 (SRSC, TEX); ca. 9 mi S of San Bartolo, *Powell and Sikes* 1670 (SRSC, TEX); 26 mi NE of Todos Santos, *Powell and Sikes* 1680 (SRSC, TEX); 2 mi NE of Eureka, *Powell and Turner* 1848 (SRSC, TEX); ca. 1 mi N of Pescadero, *Sikes and Babcock* 255 (SRSC, TEX); near km 40 between La Paz and Santo Domingo, *Thomas* 8455 (DS,

GH); 5 mi W of San Jose del Cabo, *Wiggins* 14370 (CAS, DS, TEX, UC); 8 mi E of Cabo San Lucas, *Wiggins* 14645 (CAS, DS, GH, TEX, UC).

The NY (holotype) and UC specimens of the type collection (*Rose* 16459) are typical of var. *marginata*, while the US and GH specimens (isotypes) approach var. *cuneata*. It is possible that the type collection may be mixed, containing plants of both varieties.

Some of the small forms of var. *marginata* are so like *P. californica* superficially that the two taxa can not be told apart except by microscopic examination of the achenes and pappus. The *Thomas* 8455 collection includes plants of both var. *marginata* and *P. californica*, but I have not otherwise noted sympatric occurrence of the taxa. No interspecific hybridization has been detected.

LITERATURE CITED

- ALSTON, R. E., & B. L. TURNER. 1963. Natural hybridization among four species of *Baptisia* (Leguminosae). *Am. Jour. Bot.* 50: 159-173.
- EVERLY, M. L. 1947. A taxonomic study of the genus *Perityle* and related genera. *Contrib. Dudley Herb.* 3: 375-396.
- JOHNSTON, I. M. 1929. *In*: Papers on the Flora of Northern Chile. *Contrib. Gray Herb.* 85: 127-128.
- MOORE, D. G., & E. C. BUFFINGTON. 1968. Transform faulting and growth of the Gulf of California since the late Pliocene. *Science* 161: 1238-1241.
- NILES, W. E. 1970. Taxonomic investigations in the genera *Perityle* and *Laphamia* (Compositae). *Mem. N. Y. Bot. Gard.* 21: 1-82.
- POWELL, A. M. 1968a. Additional discussions pertaining to the congeneric status of *Perityle* and *Laphamia* (Compositae). *Sida* 3: 270-278.
- . 1968b. Chromosome numbers in *Perityle* and related genera (Peritylinae — Compositae). *Am. Jour. Bot.* 55: 820-828.
- . 1969. Taxonomy of *Perityle* section *Pappothrix* (Compositae — Peritylinae). *Rhodora* 71: 58-93.
- . 1970. Natural intersectional hybridization in *Perityle* (Compositae). *Brittonia* 22: 3-10.
- . 1972a. Taxonomy of *Amauria* (Compositae — Peritylinae). *Madroño* 21: 516-525.
- . 1972b. Peritylinae, *In* IOPB Chromosome Number Reports. *Taxon* 21: 344.

- . 1972c. Artificial hybridizations in the subtribe Peritylinae (Compositae — Helenieae). *Am. Jour. Bot.* **59**: 760-768.
- . 1972d. Taxonomy of *Pericome* (Compositae — Peritylinae). *Southwest. Nat.* **18**: 335-339.
- . 1972e. New species of *Perityle* and *Amauria* (Compositae). *Madroño* **21**: 456-458.
- . 1973. Taxonomy of *Perityle* section *Laphamia* (Compositae — Peritylinae). *Sida* **5**: 61-128.
- , & S. SIKES. 1970. Chromosome numbers of some Chihuahuan Desert Compositae. *Southwest. Nat.* **15**: 175-186.
- , & H. S. TSANG. 1966. Preliminary chromatographic studies of *Laphamia* and related genera of Compositae. *Southwest. Nat.* **11**: 190-195.
- RAVEN, P. H. 1963. Amphitropical relationships in the floras of North and South America. *Quart. Rev. Biol.* **38**: 151-177.
- RYDBERG, P. A. 1914. *Carduaceae — Helenieae — Peritylinae*. *N. Am. Fl.* **34**: 11-27.
- SHINNERS, L. H. 1959. Species of *Laphamia* transferred to *Perityle* (Compositae — Helenieae). *Southwest. Nat.* **4**: 204-209.
- SOUTHWICK, L., T. J. MABRY, J. AVERETT, & A. M. POWELL. 1972. Penduletin 4'-O-Methyl Ether, a new flavonoid from *Perityle vaseyi* (Compositae). *Phytochemistry* **11**: 2351.
- STEBBINS, G. L. 1950. *Variation and evolution in plants*. Columbia Univ. Press, New York.
- TURNER, B. L. 1966. Taxonomy of *Eutetras* (Compositae — Helenieae). *Southwest. Nat.* **11**: 118-122.
- TURNER, B. L. & D. FLYR. 1966. Chromosome numbers in the Compositae. X. North American species. *Am. Jour. Bot.* **53**: 24-33.

DEPARTMENT OF BIOLOGY
SUL ROSS STATE UNIVERSITY
ALPINE, TEXAS 79830